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Backgrounder

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Sustainable Transportation in Canada



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National Round Table
on the Environment
and the Economy



Table ronde nationale
sur l'environnement
et l'économie

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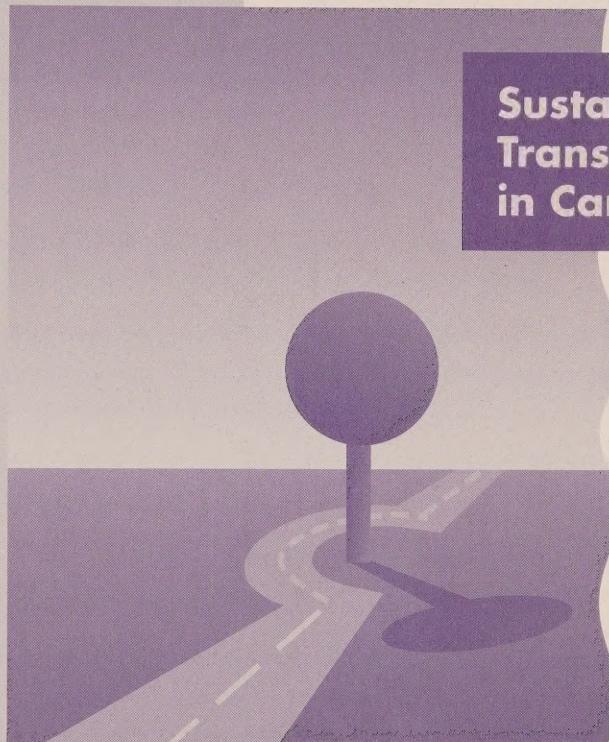
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Backgrounder

Sustainable Transportation in Canada



Prepared by Apogee Research under the direction
of the NRTEE Task Force on Sustainable Transportation.

The views expressed herein are those of the authors
and editors, and do not necessarily represent those
of the National Round Table or its members.



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Mandate

The National Round Table on the Environment and the Economy (NRTEE) was created to “play the role of catalyst in identifying, explaining and promoting, in all sectors of Canadian society and in all regions of Canada, principles and practices of sustainable development.” Specifically, the agency identifies issues that have both environmental and economic implications, explores these implications, and attempts to identify actions that will balance economic prosperity with environmental preservation.

At the heart of the NRTEE’s work is a commitment to improve the quality of economic and environmental policy development by providing decision makers with the information they need to make reasoned choices on a sustainable future for Canada. The agency seeks to carry out its mandate by:

- advising decision makers and opinion leaders on the best way to integrate environmental and economic considerations into decision making;
- actively seeking input from stakeholders with a vested interest in any particular issue and providing a neutral meeting ground where they can work to resolve issues and overcome barriers to sustainable development;
- analyzing environmental and economic facts to identify changes that will enhance sustainability in Canada; and
- using the products of research, analysis and national consultation to come to a conclusion on the state of the debate on the environment and the economy.

The NRTEE’s state of the debate reports synthesize the results of stakeholder consultations on potential opportunities for sustainable development. They summarize the extent of consensus and reasons for disagreement, review the consequences of action or inaction, and recommend steps specific stakeholders can take to promote sustainability.

Members of the National Round Table on the Environment and the Economy

The NRTEE is composed of a Chair and up to 24 distinguished Canadians. These individuals are appointed by the Prime Minister as opinion leaders representing a variety of regions and sectors of Canadian society including business, labour, academia, environmental organizations, and First Nations. Members of the NRTEE meet as a round table four times a year to review and discuss the ongoing work of the agency, set priorities, and initiate new activities.

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Preface

Transportation has pervasive impacts, both positive and negative, on the economy of Canada and on the quality of life of its citizens. Canada has a highly developed and integrated transportation network for the movement of people and goods. Its transportation systems contribute strongly to economic growth. They are necessary for all sectors of society to meet their needs and aspirations for access to other people and activities at any distance, from next door to the other side of the world.

But there is increasing evidence that the negative consequences of transportation may be overwhelming the benefits we derive from it, and that there are serious risks to society if we continue our current patterns of transportation development and use. Governments face increasing difficulties in funding expansion of transportation infrastructure and systems to meet continuous growth in demand. Social polarization is occurring between those who have access to good transportation alternatives and those who do not. There are major threats to human health and the global climate as well as other environmental concerns from unrelenting growth in the use of fossil fuels for transportation, both in Canada and around the world.

An international consensus is emerging, based on an expanding body of research, that present trends in transportation, coupled with human settlement and communication patterns, are not sustainable in the long term. Effective measures for mitigating the harmful effects of transportation have been widely researched and reported in the literature. Many federal agencies, as well as those at the provincial and municipal levels, have begun to include elements pertaining to sustainable transportation in their strategies on sustainable development.

The National Round Table on the Environment and the Economy (NRTEE), wishing to make a concrete contribution to this debate, has undertaken a Program on Sustainable Transportation. The purpose of this program is to assist the Government of Canada in developing a strategy for sustainable transportation that can be coordinated with the strategies and actions emerging from other levels of government in Canada and internationally.

This report presents a review of the domestic and international literature on sustainable transportation, and combines this with the results of interviews on sustainable transportation with key government and non-government organizations. It is intended to stimulate thought and discussion among Canadian stakeholders during the subsequent phases of the NRTEE Program on Sustainable Transportation, which will include workshops and the drafting of a state of the debate report.

The report was prepared by Apogee Research under the direction of the NRTEE Task Force on Sustainable Transportation. While many documents were reviewed and many individuals were interviewed in the preparation of this report, the authors accept full responsibility for the interpretation of the literature and of the overall state of the issues in Canada. The content of the report does not necessarily represent the position of the NRTEE or the organizations interviewed.

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Executive Summary

By almost every measure, transportation in Canada appears to be headed on an unsustainable path: greenhouse gas emissions and concentrations of some air pollutants are on the rise; the use of environment-friendly rail systems continues to decline in the face of competition from trucking; there is increasing demand for air transportation services — the fastest growing source of air pollution from transportation; and the use of public transit continues to fall.

There are many factors propelling Canadians along the path to unsustainability — including population growth, low density urban settlement patterns, the explosion of global communications and the competitive advantages of energy intensive modes of transport. But underlying these factors are deep roots in Canadian social values and lifestyles, as well as in the country's economic system and political structure.

Canadians are already experiencing the negative health impacts of unsustainable transportation. Medical research shows that ground-level air pollution in Canada is contributing to increased incidence of respiratory illness, higher physician/emergency room visits among people with heart or lung disease, and possibly increased mortality.

The potential risks from global climate change are even greater. Increasing concentrations of greenhouse gases from the burning of fossil fuels are causing warming of the ecosphere and are destabilizing global and regional climates.

In Canada, road vehicles are responsible for more than 80 percent of oil use for transportation and there is little sign of positive change. Not only are there more cars and trucks on the road, but consumer trends to larger vehicles are pushing up the average fuel consumption per vehicle. Despite continued public investments in public transportation, transit ridership has been declining in some of Canada's largest cities both in absolute volumes and in modal share over the last 10 years.

Achieving sustainable transportation requires that individuals and governments change the way they make decisions. Increased public education efforts are called for, as well as full integration of environmental objectives into transportation policies, and a shift in emphasis from mobility to accessibility — to minimize the need for motor transportation. An essential element in all of these changes is the use of quantifiable performance measures to track progress towards goals and targets.

All levels of government — international, federal, provincial/territorial and municipal — have an important role to play in achieving sustainable development. While there are signs of positive change, particularly at the municipal level, Canadian efforts have not coalesced into a well-formed national strategy for tackling urban sustainability.

Up to now, policy responses to sustainable transportation issues have focused on regulations and policies in the technology sector — for example, to control air emissions, mandate improvements in fuel quality and fuel efficiency, and promote alternative transportation fuels.

There is widespread agreement that such regulatory/technology-based approaches must be supported by major, long-term reductions in the use of high energy intensive modes of transport and shifts to lower energy consuming or non-motorized modes. As yet, few steps have been taken to implement stronger packages of policies with the potential to affect a broad range of consumer and business decisions.

Achieving sustainable transportation will require integrated policy instruments that rely on a variety of approaches, including “command and control” regulations, economic incentives, education and information, transportation and land-use planning, and technology development. Also essential is a coordinated approach involving all levels of government and other stakeholders to ensure that policy packages are consistent with jurisdictional responsibilities, avoid unnecessary duplication, and exploit synergies among policy instruments.

Given the magnitude and complexity of the change involved, a sustainable transportation system in Canada will evolve only over several decades or more. However, a number of immediate actions can be taken to improve or avoid further deterioration of the current situation, including:

- providing education on the unsustainability of current transportation practices and about actions that can be taken to support sustainability
- implementing reforms in the most affected regions (e.g., air quality non-attainment zones)
- incorporating targets for sustainability into investment, land-use and transportation planning decisions
- implementing more stringent standards for emissions control and fuel efficiency
- raising fuel prices to encourage fuel efficiency improvements and alternative fuel technologies, mode shifting and reduced vehicle use
- focusing on research and development aimed at reducing fossil fuel consumption from transportation

The above findings are based on a preliminary review of current research and activities in this sector, and are not intended as a comprehensive set of recommendations for action. It is hoped, however, that they will provide food for thought among stakeholders, and stimulate discussion on the future of sustainable transportation in Canada.

Introduction

The objective of this report is to summarize current understanding in Canada of the issues relating to how transportation can be economically, socially and environmentally sustainable over the long term. The purpose of the study, performed by Apogee Research for the NRTEE Task Force on Sustainable Transportation, was to provide background information in a concise format, which could be used as the foundation for later phases of the NRTEE Program on Sustainable Transportation.

This review covers the goals, strategies and actions of all levels of government, not just the Government of Canada. If sustainable transportation is to be achieved, it is important that the actions of any one jurisdiction positively reinforce those of others, wherever possible avoiding duplication or conflict. This is particularly important in Canada, because of the fragmentation of decision making for transportation in this country.

Chapter 1 of this report summarizes some of the trends that have led researchers and other commentators to conclude that transportation has become unsustainable. It reviews the most serious impacts of unsustainable trends in transportation, including health impacts and global climate change. Chapter 1 also addresses the relative contribution of different modes to the unsustainability of transportation in Canada. Chapter 2 outlines elements of analysis as well as policy and program development that have been reported in the literature. It describes some of the broad tools that have been used or considered in policy development for sustainable transportation. Chapter 3 summarizes specific policy options that have been studied and/or implemented in Canada and internationally, and describes associated jurisdictional and timing issues.

Acronyms

ACEEE	American Council for an Energy-Efficient Economy
APEC	Asia Pacific Economic Cooperation
AQMP	Air Quality Management Plan
CAAA	Clean Air Act Amendments (U.S.)
CAFC	Corporate Average Fuel Consumption
CAFE	Corporate Average Fuel Efficiency
CCME	Canadian Council of Ministers of the Environment
CGSB	Canadian Government Standards Board
CMHC	Canadian Mortgage and Housing Corporation
CMTC	City of Montreal Transit Commission
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
COP3	Third Conference of Parties of the UN Framework Convention on Climate Change
ETBE	Ethyl Tertiary Butyl Ether
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GTA	Greater Toronto Area
GVRD	Greater Vancouver Regional District
I&M	Inspection and Maintenance
ICLEI	International Council for Local Environmental Initiatives
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ISTEA	Intermodal Surface Transportation Act (U.S.)
MCP	Model Communities Program
MOEE	Ontario Ministry of Environment and Energy
MTO	Ontario Ministry of Transportation
NGL	Natural Gas Liquid
NIMBY	Not in my backyard
NOx	Nitrogen Oxides
NRCan	Natural Resources Canada
NRTEE	National Round Table on the Environment and the Economy
OECD	Organization for Economic Cooperation and Development
PNGV	Program for a New Generation of Vehicles
RMOC	Regional Municipality of Ottawa-Carleton
RRADs	Respiratory-Related Restricted Activity Days
TAC	Transportation Association of Canada
TFFC	Tax For Fuel Conservation (Ontario)
TTC	Toronto Transit Commission
VKmT	Vehicle Kilometres Travelled
VOC	Volatile Organic Compound

The Unsustainability of Transportation in Canada



Unsustainable Transportation: Trends and Causes

Transportation in Canada appears to be headed on an unsustainable path. Consider the following trends:

- Transportation is the fastest growing source of greenhouse gas emissions from human activity. Natural Resources Canada (NRCan) projects that greenhouse gas emissions from Canadian transportation will rise 52 percent between 1991 and 2020. Per capita emissions of greenhouse gases from transportation in Canada and the U.S. are approximately three times greater than the average in other countries of the Organization for Economic Cooperation and Development (OECD).
- Despite tighter vehicle emissions regulations and reductions in some air pollutants, concentrations of ground level ozone and particulates in urban areas of Canada increased between 1981 and 1990, largely because of increases in the numbers of new vehicles, the average size of vehicles and the distance they are driven each year. These factors have combined to overwhelm advances in vehicle technologies and in the development and use of cleaner fuels. Increased negative health impacts have been associated with ozone and particulates in epidemiology studies.
- Government responses to date are not expected to reduce total emissions. For example, the most ambitious plan, the Air Quality Management Plan of the Greater Vancouver Regional District, will only stabilize ground level emissions from all sources in 2020 at current levels, in large part because of the expected doubling of the number of vehicles in the region by that year.
- There is a growing population of elderly people, who are no longer able to drive and do not have direct access to good public transportation. They are often isolated and dependent on others for access to any needs outside their homes.
- The relative decline and rationalization of rail systems for moving goods in Canada continues in the face of competition from trucking. Current market conditions are driving this modal shift despite the fact that energy use and associated environmental impacts of trucking are several times greater per tonne-kilometre than those of rail.
- Air transportation is the fastest growing source of air pollution from transportation. Both the public and private sectors face major challenges in financing the infrastructure needed to meet relentless increases in demand. All indicators point to continuing growth in air transportation at rates that will overwhelm any projected advances in aviation fuel efficiency.
- Despite continuing investments in public transit, the modal share of transit continues to fall in Canada.

- Governments face declining financial resources for maintaining and expanding transportation infrastructure. From airports to highways to marine ports, governments are divesting themselves of responsibility for funding the massive additions to infrastructure that will be necessary if current demand trends continue.
- Even if the financial challenge of meeting demand for transportation infrastructure could be met, one observer suggests there is a boomerang effect in expanding transportation systems. “If we build a freeway system or an extended airport system to meet some prediction of future demand, then we should not be surprised to discover that these investments hasten our progress in that direction. Our plans and analyses boomerang so that our efforts are rewarded by the return of the problem, usually with some force and destructive impact.”¹

What is propelling us on such an unsustainable path? At first glance, it appears that population growth, low density urban settlement patterns, the explosion of global communications and the competitive advantages of energy intensive modes of transport, including cars, trucks and aircraft, have combined to make transportation unsustainable.

Underlying these factors, however, are the deep roots unsustainable transportation trends have in Canadian social values and lifestyles, as well as our economic system and political structure. For example:

- Unlimited personal mobility, often in single-occupant vehicles, is viewed by many as a right. Calls to curtail travel are seen as draconian measures that impinge on basic freedoms.
- Cars continue to be one of the most important status symbols for many Canadians. People see sport utility vehicles, high performance sports cars, luxury cars or, in the case of many teenagers, any car at all as symbols of lifestyle and wealth.
- A home in the suburbs remains a key component of the Canadian dream. Fierce opposition to high density or infill development often arises from nearby homeowners. Ironically, these not-in-my-backyard (NIMBY) reactions often argue against such development in the name of “environmental protection.”
- The current division of political powers fragments transportation and development decision making, and in particular separates much transportation planning from land-use planning. Municipalities approve suburban development, following provincial planning legislation, leaving provincial governments to face increased demand for highways to service those suburbs. The federal government has been responsible for railways while trucking is largely the responsibility of provinces.
- Canadian consumers demand and get strawberries flown from Chile, tangerines shipped from Morocco and tomatoes trucked from Mexico. International trade in food products is only one of many examples of the market’s ability to satisfy the

desires of consumers with a growing capacity and willingness to pay, despite the environmental, social and economic consequences. Trade liberalization is increasing the international flow of goods.

- Children, who in previous decades would have walked, ridden bicycles or taken public transit to school, the hockey rink or the ballet class, are now driven because of fear for their safety or the physical distances between home, school and recreation facilities, and the lack of accessible alternatives.
- Masses of people now take annual vacations using air transportation to get to international destinations. A family of four flying to Disney World uses over 12 times more fuel than they would have consumed making the same trip by car. A passenger flying from Toronto to Paris consumes enough fuel to drive a car for about a year.
- The high costs of infrastructure serving suburban areas are frequently paid for out of general tax revenues, not by the people responsible for the demand. Access to such publicly funded infrastructure is seen as a right, while user fees are criticized as tax grabs.
- Under current market conditions, users do not pay for the full social costs of transportation. Therefore, transportation is “over-used” from an efficiency perspective.

Unsustainable Transportation: Impacts

Transportation has many negative impacts that are not adequately accounted for in the market place's seemingly insatiable appetite for more mobility. Key among these impacts are the following:

- Human health impacts from ground level air pollution.
- Crop and forest damage from air pollution.
- Climate change impacts of greenhouse gas emissions from the burning of fossil fuels.
- Land use for transportation infrastructure, resulting in loss of natural habitat and land for agricultural, recreational, residential and other public uses.
- Economic inefficiency, and loss of regional competitiveness due to continued low density, single-use urban sprawl, which is linked to automobile dependency.
- Social isolation from the barrier effects of transportation infrastructure, and from everyday activities for those who do not have direct access to cars.
- Other environmental impacts related to the life cycle production, use and disposal of transportation vehicles and infrastructure.
- Death and injury from accidents.

- Time lost, costs, inconvenience and environmental impacts of traffic congestion.
- Increasing time and distances required for commuting and travel for other purposes.
- Reductions in transit service and ridership.
- Water pollution from runoff from roads and other infrastructure.
- Noise and vibration.

There have been many estimates of the external costs of the impacts of unsustainable transportation. While it is unlikely that precise values can ever be developed, external costs have been clearly shown to be substantial. The OECD estimates that external costs represent approximately 5 percent of gross domestic product in OECD countries.

The most comprehensive study of external costs and full cost pricing for transportation in Canada was a report by the IBI Group for the Ontario Transportation and Climate Change Collaborative.² This report presents the following conclusions:

- Only buses come close to paying their full costs among passenger transportation modes.
- Both intercity car and airline travellers pay less than the full cost of their transportation mode.
- Passenger rail is by far the most heavily subsidized mode on a per passenger-kilometre basis, reflecting low ridership relative to service levels provided.
- Total subsidies for intercity truck operations (excluding fuel taxes and licence fees) at 2.19 cents per tonne-kilometre are considerably higher than they are for rail freight, at 0.40 cents per tonne-kilometre.
- Urban transit and automobile modes each receive total public subsidies from provinces and municipalities in the range of 12 cents per passenger-kilometre. However, external costs for urban auto, at 10 cents per passenger-kilometre, are much higher than those of public transit. External costs for the latter are approximately 1.4 cents per passenger-kilometre.

In Canada, the primary focus of attention in sustainable transportation is on the impacts of ground level air pollution and greenhouse gases. Of particular concern are the impacts of increasing concentrations of ground level ozone, airborne particulates and carbon dioxide.

At the same time, much attention is being paid to the economic and social implications of the continuing low density of human settlement patterns, particularly in the major urban areas of Canada. The financial constraints on all levels of government are forcing municipal and regional decision makers to reconsider land-use practices and to look for more cost-effective ways to develop urban infrastructure. There is widespread, though by no means universal, consideration of more compact,

mixed-use development as one way to address this issue. There has been less emphasis, until relatively recently, on the connections between the unsustainability of transportation and patterns of land use.

Health Outcomes from Air Pollution

In a recent assessment of the health effects of air pollution in Canada, two expert panels concluded that “health effects of ground level ozone at levels that occur in Canada include pulmonary inflammation, pulmonary function decrements, airway hyperactivity, respiratory symptoms, possible increased medication use and physician/emergency room visits among individuals with heart or lung disease, reduced exercise capacity, increased hospital admissions and possibly increased mortality.”³

At the “Conference on Transportation, Air Quality, and Human Health,” cosponsored by Pollution Probe and York University in April 1996, Dr. David Bates, Professor Emeritus of the Department of Health Care and Epidemiology at the University of British Columbia, pointed to tropospheric ozone and particulates as the pollutants presenting the most severe health challenges. Road transportation, in particular, is a primary source of these pollutants. Dr. Bates cited the work of Dr. Rick Burnett of Health Canada in establishing a close association between hospital admissions of infants below one year of age with a diagnosis of “infections” and ambient ozone levels in summer. This conclusion was drawn from a study of hospital admissions in 168 hospitals in Ontario, and is corroborated by studies in other regions and countries. There is also good evidence that ozone exposure “enhances the response to a subsequently delivered allergen in asthmatics There is independent evidence that both ozone and fine particulate pollution (PM10), are associated with increased symptoms in asthmatics, and increased hospital admissions for pneumonia”⁴ (PM10 and PM2.5 refer to particle sizes of less than 10 microns and 2.5 microns, respectively.)

Independent studies of data on large numbers of Americans in 17-year longitudinal studies by the American Cancer Society and the Harvard School of Public Health have shown a strong association between elevated levels of sulphates in the atmosphere and cardiopulmonary deaths. Sulphates and related fine particulates are particularly associated with the burning of diesel fuels.

A report prepared for the B.C. Ministry of Environment, Land and Parks concluded that for each 10 micrograms per cubic metre increase in the level of PM10, the following health effects are estimated to occur:⁵

- 0.8 percent increase in hospitalizations;
- 1.0 percent increase in emergency room visits for respiratory illness;
- 9.5 percent increase in days of restricted activity due to respiratory symptoms;
- 4.1 percent increase in school absenteeism; and
- 1.2 percent increase in reporting of coughs.

To put the above impacts in context, the B.C. Ministry of Environment, Land and Parks and the Greater Vancouver Regional District have adopted an objective of 50 micrograms per cubic metre as a 24-hour average. Preliminary indications, from recently improved monitoring of fine particulates, are that the objective is regularly not being met in many B.C. urban areas. The provincial medical officer has recently indicated that health concerns are evident at levels as low as 20 micrograms per cubic metre.⁶

A national air quality objective for PM10 is being developed by the Canadian Environmental Protection Act Working Group on Air Quality Objectives and Guidelines. This group has also decided to propose the development of a PM2.5 objective, since the finer particles are believed to be responsible for the majority of health effects in the respirable particle category.

Studies in the United States have estimated the following annual health outcomes of air pollution from highway vehicles in 1991:

- Approximately 20,000-46,000 cases of chronic respiratory illness.
- Roughly 50-70 million respiratory-related restricted activity days.
- An estimated 530 cases of cancer from air toxics associated with highway use. Estimates of cancer risk, however, are highly uncertain.
- About 852 million headaches from carbon monoxide associated with motor vehicle use.
- An estimated 40,000 premature deaths in the United States of which 33,000 can be attributed to particulate matter — a number comparable to the number of deaths from motor vehicle accidents.⁷ (Note: these numbers are of the same order of magnitude as the number of Americans killed in the Vietnam war.)

Furthermore, research at Health Canada has shown a strong association between sulphate levels and hospitalization rates in Ontario. Ongoing work in Canada is also establishing links between ambient levels of several pollutants and emergency room visits and hospitalization rates.

Policy making is easier when impacts of proposed changes can be quantified. In order to estimate the monetary value of health or other environmental benefits achievable by government policies, analysts use the so-called Damage Function approach in which benefits are expressed as reduced damages from a base case, unreduced emission forecast scenario.

A report prepared for the Canadian Council of Ministers of the Environment estimated that the total undiscounted health benefits, between 1997 and 2020, of two different regulatory scenarios for reducing emissions of smog and particulate precursors would range from a low of \$10.8 billion to a high of \$38.2 billion.⁸ Regionally, about 73 percent of total benefits would be realized in the Windsor-Quebec corridor. Approximately 99 percent of these benefits would relate to reductions in particulates.

The Ontario Ministry of Environment and Energy (MOEE) is considering an annual emission reduction target of 45 percent for nitrogen oxides (NOx) and volatile organic compounds (VOCs) in 2015 relative to 1990 levels. This target is proposed as part of a provincial smog management plan, which will be incorporated into a National Smog Strategy for Canada. The latter is being coordinated by the National Air Issues Coordinating Committee as an extension of the 1990 NOx/VOC Management Plan. The MOEE has estimated that the annual discounted present value of the health benefits achievable in Ontario by meeting this target would range from \$320 million to \$476 million.⁹ The MOEE acknowledges the uncertainties in estimating monetary values for health impacts since the benefit categories are public goods with no market prices associated with them.

A cost-benefit study for the Greater Vancouver Regional District, the B.C. Ministry of Environment, Land and Parks, and Environment Canada estimates that “2,800 premature deaths, 33,000 hospital emergency room visits, 13 million restricted activity days and five million personal health symptoms such as chest discomfort” would be averted by the Air Quality Management Plan for the Greater Vancouver Regional District. “It will also reduce damage to crops, materials and property. From 1985-2020, ... the plan will cost \$3.8 billion to implement, create benefits of \$5.4 billion and result in a net saving of \$1.6 billion over this time period.”¹⁰

The last comment on the health outcomes of air pollution from transportation is left to Dr. Bates. “There is no task confronting us that more cogently demands our full attention, than to ensure that we are building a sustainable society for the future; such a society, at the very least, has to have air pollution levels below those which injure its members.”¹¹

Global Climate Change

Global climate change is an issue with potentially even greater risk to the human species than air pollution. The Intergovernmental Panel on Climate Change, made up of 2,500 leading scientists and climatologists from more than 100 countries, has concluded that increasing concentrations of greenhouse gases in the atmosphere from the burning of fossil fuels appear to be causing warming of the ecosphere and destabilizing global and regional climates.

There is also growing evidence that the measures available for dealing with the climate change issue are central to dealing simultaneously with a range of other global and local issues. For example, measures that would result in major reductions in greenhouse gas emissions from transportation would also contribute to improvements in ground level air quality. The reverse is not necessarily true. Measures for dealing with greenhouse gas emissions from transportation have also been shown to provide economic and social benefits. For example moving to more compact urban form and improving the design of streetscapes for pedestrian and transit operations can result in lower cost urban infrastructure and reduced social isolation for those without access to automobiles. At the same time, single-occupancy vehicle use is reduced, with corresponding reductions in per capita use of fossil fuels.

However, “unless there is major policy intervention, transportation energy use could increase 40 to 100% by 2025 and as much as 400% by 2100.”¹² It should be noted that massive changes in individual and collective behaviour worldwide would also be required to avoid this scenario.

Continued increases in concentrations of greenhouse gases in the stratosphere are expected to affect “unmanaged ecosystems (coral reefs, boreal forests), human health (e.g., increases in health impacts from more frequent ozone events associated with higher ambient temperatures), effects of sea level rise and the potential for more severe natural disasters.”¹³ Other studies of specific regional effects suggest dramatic impacts from a doubling of carbon dioxide (CO₂) concentration in the atmosphere. One such effort was conducted for the Ontario Transportation and Climate Change Collaborative.¹⁴

While transportation systems consume a wide range of resources, the one of greatest concern is fossil fuels, and oil in particular. Worldwide, the transportation sector accounts for more than 60 percent of oil products, which constitute about 98 percent of transportation energy use. The latter percentage has increased from 92 percent in 1960 in spite of efforts by many governments to encourage substitution of other fuels, both non-renewable and renewable.

Projections of growth in transportation energy use — assuming no major new policy interventions or unanticipated shifts in consumption from changing market forces, whether at the global, domestic, or provincial levels in Canada — all point to increasing energy consumption by the transportation sector (Exhibit 1.1).

Exhibit 1.1

Projections of Transportation Energy Consumption

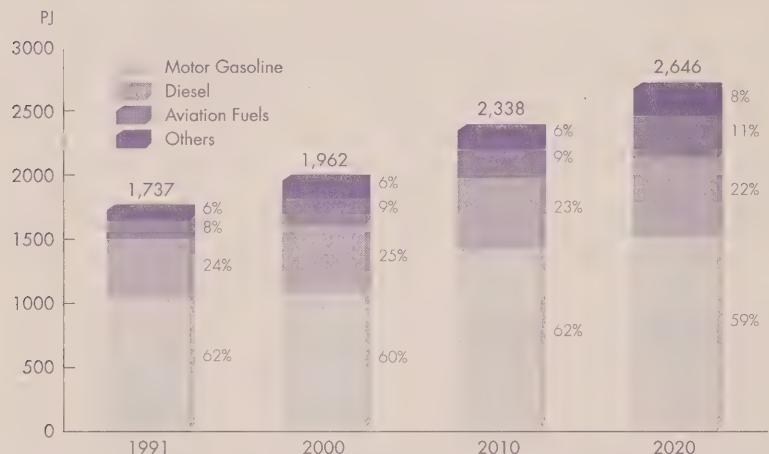
Geographic Region	Time Period	Percent Increase
Global ^a	1990-2030	73
OECD Countries ^b	1990-2030	18
Canada ^c	1991-2020	52
British Columbia ^d	1990-2010	21
Ontario (Road) ^e	1990-2015	43
United States ^f	1990-2015	45

Sources: ^a Organization for Economic Cooperation and Development, *Motor Vehicle Pollution: Reduction Strategies beyond 2010* (Paris, 1995); ^b Organization for Economic Cooperation and Development, *Environmental Criteria for Sustainable Transportation* (Paris, 1996), Table 2, p. 22; ^c Natural Resources Canada, *Canada's Energy Outlook: 1992 to 2020* (Ottawa, September 1993), modified to reflect revisions to forecast demand in NRCAN, *Update 1994* (Ottawa, October 1994), Table 3.1, p. 9; ^d B.C. Ministry of Environment, Land and Parks, *Clean Vehicles and Fuels for British Columbia, A Policy Paper* (Victoria, April 1995); ^e Apogee Research, *A Policy Instruments Working Paper on Reducing CO₂ Emissions from the Transportation Sector in Ontario*, paper prepared for the Transportation and Climate Change Collaborative, November 1995, p. 21; ^f Bryan Smith, General Motors of Canada, *Notes from the U.S. Car Talk Group*, June 1995.

Natural Resources Canada projects that overall transportation energy demand in Canada will increase by approximately 52 percent between 1991 and 2020. This estimate is based on current trends and assumptions by NRCan about the impacts of such factors as economic growth, transportation fuel efficiencies, shifts to alternative fuels, public transit and telecommuting.¹⁵ In fact, transportation energy consumption could be higher than forecast if urban transit ridership continues to decline, or if the hoped-for reduction in automobile use as a result of increased telecommuting does not become a reality. The projections are shown in more detail in Exhibit 1.2.

Exhibit 1.2

Transportation Energy Demand (1991-2020)



Source: Natural Resources Canada, *Canada's Energy Outlook: 1992 to 2020* (Ottawa, September 1993), p. 25, modified to reflect revisions to forecast demand in NRCan, *Update 1994*, October 1994, Table 3.1, p. 9.

Clearly, even if these forecasts indicate accurately only the direction of current trends in transportation demand in Canada, conditions for sustainable transportation will not be met in this country over the next quarter century, simply because the use of fossil fuels in transport will continue to increase.

Much of the debate about sustainable transportation centres on the problem of automobile dependence, which includes “loss of community, reduced air quality; climate change; consumption of large amounts of space for roads and parking; intrusion of automobiles into neighbourhoods; boredom in the suburbs; and, in some countries, guarded communities. On a global scale, the imminent peaking in the next century of global oil production is also cause for concern.”¹⁶

Relative Modal Contributions to Unsustainability

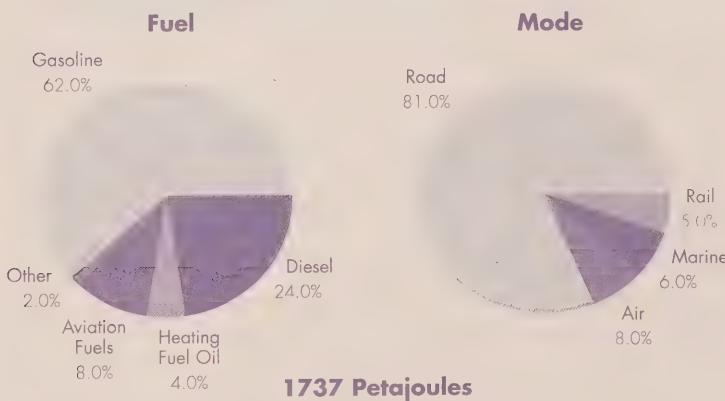
In 1994, transportation in Canada was responsible for 31.4 percent of carbon dioxide emissions from all sources of human activity.¹⁷ The percentages of emissions from various modes, by fuel, are summarized in Exhibit 1.3.

In Canada, road vehicles are responsible for more than 80 percent of oil use for transportation. Air transportation, at 8 percent, is the next largest and fastest growing user of petroleum energy.

Road transportation clearly dominates the transportation use of energy and emissions of carbon dioxide in Canada. Gasoline-powered vehicles are the largest single contributor, followed by diesel-powered trucks and other vehicles such as buses. In the case of heavy trucks, the majority of fuel is consumed for intercity movement of goods.

Sales of cars in Canada have been stable or declining in recent years, while those of vans, sport utility vehicles and light trucks have been growing strongly.^{18, 19} As a result, not only are total motor vehicle registrations growing, but average fuel consumption per vehicle is increasing because of the market trend to larger vehicles.

Transportation Energy Demand (1991)



Source: Natural Resources Canada, *Canada's Energy Outlook: 1992 to 2020* (Ottawa, September 1993), p. 22.

Energy demand is expected to grow in all transportation modes. The projections of NRCan are based on assumptions about increasing fuel efficiency and anticipated increases in demand for each mode. Projected annual growth rates to the year 2020 are shown in Exhibit 1.4.

Exhibit 1.4

Annual Average Growth Rates for Transportation in Canada (1991-2020)

Mode	Percent Growth
Road	1.6
Air	3.1
Rail	2.9
Marine	1.4
Total	1.8

Source: Natural Resources Canada, *Canada's Energy Outlook: 1992 to 2020* (Ottawa, September 1993), p. 25.

These projections and the assumptions behind them were revised by NRCan in their 1994 *Update*. They will no doubt change again in future. The general conclusions that energy demand is expected to grow for all modes, and that growth in aviation will be the fastest, still hold, if there are no significant changes in societal behaviours and/or government policy interventions. Again, by any definition of sustainable transportation, Canada is headed in the wrong direction.

Trends Away from High Energy Efficiency Modes

A useful way of looking at the sustainability of different modes is to consider the total life cycle of greenhouse gas emissions, expressed in carbon dioxide equivalents, per unit of transport delivered (either grams per passenger-kilometre or grams per tonne-kilometre for freight). Exhibits 1.5 and 1.6 provide such modal comparisons, from one study, for passenger and freight transportation respectively.

Exhibit 1.5

Greenhouse Gas Emissions by Mode Passenger Transport

Grams of CO₂ Equivalent

Mode	Grams
New catalyst car	197
Diesel car	161
Bus	69
Diesel train	79
Electric train	76
Local train	54
Aircraft	853

Source: David Martin and Laurie Michaelis, *Research and Technology Strategy to Help Overcome Environmental Problems in Relation to Transport* (U.K. Atomic Energy Authority, March 1992).

Exhibit 1.6

Greenhouse Gas Emissions by Mode Freight Transport

Grams of CO₂ Equivalent

Mode	Grams
7.5-tonne truck	174
40-tonne truck	56
Fast rail	39
Slow rail	14
Aircraft	3,414

Source: David Martin and Laurie Michaelis, *Research and Technology Strategy to Help Overcome Environmental Problems in Relation to Transport* (U.K. Atomic Energy Authority, March 1992).

The figures shown are for U.K. vehicles. On average North American automobiles emit about 50 percent more carbon dioxide per passenger-kilometre. This results in an aircraft/car ratio of about three and a car/transit ratio in the range of five. The limitation of these kinds of comparisons, of course, is that they do not take into account the utility or benefit to the user of using the more energy intensive mode. Market forces, in the absence of full cost accounting or mandated overall energy consumption targets, will result in choices that may be suboptimal in environmental impacts. But such comparisons do facilitate understanding of where to look for possible ways to address the sustainable transportation dilemma.

Urban Automobile Use versus Public Transit

Despite continued public investments in public transportation, transit ridership has been declining in some of Canada's largest cities both in absolute volumes and in modal share over the last 10 years.²⁰ For example, although the core of the City of Toronto, at 43 persons/hectare, and Metro Toronto, at 35.7 persons/hectare, have high enough population density to support public transit, ridership has fallen. This fall is, at least in part, due to recessionary job losses since 1988, loss of growth momentum, and the spread of low density suburban communities. The latter has been made possible by the continued development of the road network in the Greater Toronto Area, where the population density on average is about five persons/hectare, insufficient for financially viable transit. The population of Metro Toronto represents 50 percent of the 4.5 million people who live in the GTA.

Urban transit is several times more energy efficient per passenger-kilometre than the automobile. Transit is also much less land-use intensive, and is more inclusive in that it provides access for those who do not drive cars. It follows that much more progress could be made toward sustainable transportation if the modal share of transit could be substantially increased in urban areas. Current trends are in fact in the opposite direction, despite continued calls for increased funding priority by public transit advocates.

In the Greater Toronto Area, transit modal share, including GO Transit, for all daily trips was 14 percent in 1991, a decrease of 3 percent from 1986. Automobile share in 1991 in the GTA for all trips was 77 percent, an increase of 3 percent.²¹ In this period, population in the GTA increased by about 10 percent to 4.57 million. In contrast, the modal share of total trips to the core of Toronto (Planning District 1) in 1991 was 41 percent automobile and 45 percent for public transit. The same percentage decline in transit use occurred in the core as in the GTA region.

Between 1988 and 1994, the absolute level of ridership on the Toronto Transit Commission (TTC) network declined by about 16 percent. This trend is unlikely to be reversed in the near future, given the fare increases and rationalization of services the TTC has had to impose to make up for lost revenue. Similarly, despite extensive investments in public transit in past decades, automobile use in the Lower Fraser Valley in British Columbia continues to climb. Absolute levels of transit ridership increased by about 22 percent in the period 1985 to 1992. In the same period, however, trips by car drivers increased by about 43 percent. As a result, transit modal share decreased by 11 percent. Furthermore, average trip speeds in the Greater Vancouver Regional District (GRVD), in the same period, decreased by about 8 percent.²²

According to Transport 2021, a joint planning project of the GVRD and the Province of British Columbia, the number of vehicles in the Lower Fraser Valley is expected to double from the current fleet of one million by 2021. "Even with the existing programs and the full GVRD Air Quality Management Plan (AQMP), emissions are projected to increase beyond the year 2000."²³ The measures in the AQMP focus primarily on local air quality. British Columbia projects that carbon dioxide emissions from transportation will increase by 12 percent from 1990 to 2000 and 21 percent from 1990 to 2010.

Such are the powers of the market and the aspirations of citizens for "mobility" that they have, acting rationally and in their own interests, used the personal transportation freedom of the automobile, as well as increasing disposable income, to create expanding urban sprawl, and to increase the distances between activities. While the benefits of road transport are embedded in the public psyche and have driven much political action in past generations, the public is only now becoming aware of the disbenefits of continuously expanding transportation and low density land use.

Fossil Energy Intensity and Freight Transport — Truck, Rail and Marine

In Canada, the rail mode carries the greatest share of freight tonnage (54.3 percent or 479 million tonnes in 1992), followed by marine, truck and air modes.²⁴ By comparison, trucking in Ontario carries the greatest share of freight, at 40.1 percent or 100 million tonnes. This is followed by rail (37 percent or 92 million tonnes), marine (23 percent or 57 million tonnes) and air (0.1 percent or 250 thousand tonnes).

The most important trend in the past two decades has been the growth of the truck mode. Between 1980 and 1990, tonnage moved by truck increased by 56 percent. This growth appears to have come at the expense of rail, since overall freight tonnage experienced little net change in this period. The Canadian Institute of Guided Ground Transport reports the modal split between rail and truck for 1989, using three different measures shown in Exhibit 1.7.

Exhibit 1.7 **Percentage of Rail and Truck Movement of Goods in Canada (1989)**

Measure	Rail	Truck
Revenue-based market share	23.1	76.9
Tonne-kilometre market share	66.5	33.5
Tonnage-based market share	40.0	60.0

Source: Canadian Institute of Guided Ground Transport, *Estimation of Railway Freight Market Shares — 1989*, report for CN Rail Intermodal, February 1993, p. 3.

The energy consumption per tonne-kilometre of truck movement of goods ranges between 1.3 and 5.1 times greater than by rail.²⁵ For movement of mixed freight over long distances, the U.S. Office of Technology Assessment estimates the energy consumption of rail ranges between 150 and 310 BTU per ton-mile (220 and 450 BTU per tonne-kilometre). Trucking uses between 770 and 980 BTU per ton-mile (1,120 and 1,430 BTU per tonne-kilometre) for the same service.

The above numbers suggest the possibility of modal shifting to rail to make freight transport more sustainable. However, for the majority of goods movement, truck and rail do not compete directly. The Ontario Trucking Association estimates that rail and truck actually compete at distances over 500 kilometres.²⁶ However, 90 percent of truck traffic moves less than 600 kilometres and 95 percent moves less than 700 kilometres. The percentage of freight movement for which there is direct competition between truck and rail is therefore relatively small. Within this range there is increasing cooperation among the two modes through intermodal operations.

In the markets where trucking dominates, shippers value the response time, flexibility and reliability of trucking, and are willing to pay premium rates relative to rail for these attributes. The built infrastructure, including massive expansion of roads in recent decades, as well as the location decisions of businesses, has been strongly responsive to the market in the urban regions of the country.

Some research suggests that relative subsidy levels for trucking in past decades have contributed to the competitiveness and growth of the trucking industry at the expense of rail, just as the long-term history of low gasoline prices and availability of land have contributed to urban sprawl. However, this is a contentious and complex issue in Canada as it is in other countries. There is no consensus about the relative effects of taxation and subsidies compared to the strong market forces that have accelerated growth in the trucking mode. There has been limited study of the long-term impact of fuller cost accounting approaches on the modal split between truck and rail, or the potential for encouraging a larger portion of goods movement to use intermodal services.²⁷

Given the contribution of intercity trucking to the unsustainability of transportation in Canada, industry and governments could work together to look for innovative policies and programs, including economic instruments, to encourage increased long-term shifts to intermodal operations. Questions to be explored include:

- How could automobile manufacturers, their suppliers and governments work together to develop incentives for suppliers to locate factories closer to their customers to reduce the tonne-kilometres of just-in-time truck delivery of parts to auto assembly plants?
- How could the advanced logistics management techniques, used by major companies to reduce end-to-end logistics costs, be used more generally to reduce the number of vehicle movements per tonne of goods transported?
- How could urban planning and design, tax policy and technology advances be combined to shift more goods movement to intermodal truck/rail services?

The main transportation corridor in Canada where the marine mode might have significant opportunities to compete with trucking and rail for freight movement is the St. Lawrence Seaway. Since shipping is the least fossil energy intensive of these three freight modes, factors causing modal shifting away from the marine mode should be examined and actions, where cost effective, taken to enhance its modal share.

Air Transportation

As noted above, air transportation is forecast to remain the fastest growing mode for the foreseeable future. It is also the most energy intensive mode per passenger-kilometre or tonne-kilometre of freight. If current rates of growth continue, and aircraft continue to rely on petroleum fuels, air transportation is expected to become as serious a contributor to greenhouse gas emissions as road transportation.

Air transportation could also become a significant contributor to the greenhouse effect. Nitrogen oxides produced during combustion of aviation fuel at high altitude can contribute to ozone formation. Ozone is at its most effective as a greenhouse gas at altitudes of about 8,000 metres at the poles and 17,000 metres at the equator, in the range where commercial jet aircraft fly. The indirect greenhouse effect resulting from NOx production at high altitudes could be approximately equal to the effect of carbon dioxide emissions from aviation.²⁸ To date, there has been little work done in Canada, or indeed globally, on the sustainability of air transportation.

Footnotes

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4 David Bates, *The Inconvenient Implications of Current Data on Air Pollution*, presentation at the Conference on Transportation, Air Quality and Human Health, York University, April 25, 1996.

5 Pollution Probe, *Transportation, Air Quality and Human Health, Issues and Perspectives*, paper prepared for Health Canada, March 1996, p. 7.

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7 D. McCubbin and M. Delucchi, *Health Effects of Motor Vehicle Air Pollution in the U.S.*, as cited in Apogee Research, *Indicators of the Environmental Impacts of Transportation*, paper prepared for the U.S. Environmental Protection Agency, June 1996.

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24 Transmode Consultants, *Ontario Freight Movement Study*, report prepared for the Transportation and Climate Change Collaborative, June 1995, p. 5.

25 U.S. Office of Technology Assessment, *Policy Options for Energy Conservation* (July 1994), p. 249.

26 Ontario Trucking Association, *Submission of the Ontario Trucking Association to the Federal Government Task Force on the Commercialization of the Canadian National Railway*, December 1995, p. 5.

27 IBI Group, *Full Cost Transportation and Cost-Based Pricing Strategies* (Toronto: Transportation and Climate Change Collaborative, November 1995).

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**Analysis and
Policy/Program
Development tools**

Visions of Sustainable Transportation

Vision statements present desired futures in lieu of the outcomes expected from current trends or the status quo. Therefore, a vision typically talks about the future, but contains underlying assumptions about where we will be if no action is taken.

Many visions *related to* sustainable transportation are recorded in the literature. However, few address the full range of environmental, social and economic issues involved in sustainable transportation. Instead, most focus on a specific mode (particularly road), a specific region (particularly urban travel) or a specific set of air emissions (particularly smog and greenhouse gas emissions). This is not necessarily a significant constraint since addressing one aspect of sustainability will often have spin-off benefits on other aspects.

Visions for sustainable transportation are based on the consensus developing around the world and in Canada that:

- Transportation has become environmentally, socially and economically unsustainable.
- Deterioration in the quality of life — including negative health effects, increased social isolation, psychological stress, increased energy costs, and reduced economic efficiency — will continue under current trends.
- The most serious impediments to sustainable transportation are continued growth in urban automobile use, intercity truck transport of goods and air transportation.
- The growth in automobile use is highly correlated to historical patterns of low density, single-use development in major urban areas, increasing disposable income of consumers and advances in vehicle technologies.
- Urban form and transportation systems have evolved under policies that do not require market players, including consumers, to pay the full environmental, social, health and safety and economic costs of their transportation or land-use decisions.
- Change will be required over the next 25 years or longer, even if steps are taken immediately to induce the massive changes in behaviour, technology and infrastructure required for truly sustainable transportation.
- It is uncertain whether there is *any* set of policies that could gain political acceptance at this time and that would result in truly sustainable transportation.

The desired future portrayed in vision statements typically includes the components listed in Exhibit 2.1.

Typical Components of Sustainable Transportation Vision Statements

- ◆ Changed public values based on understanding of the seriousness of inaction and the benefits of sustainable development and transportation practices.
- ◆ Increased commitment of citizens and government to achieving sustainable transportation.
- ◆ Transition from dispersed, single-use urban, suburban and rural development to more compact, mixed-use and liveable neighbourhoods that reduce travel and shipping needs and solve multiple social, environmental and economic problems.
- ◆ Emphasis on accessibility rather than mobility.
- ◆ Increased availability of more sustainable alternatives, including walking and cycling, public transit and use of information technologies to reduce travel needs.
- ◆ Increased use of more sustainable alternatives for moving goods in cities, as well as reduced need to move goods over any distance.
- ◆ Viable urban and intercity rail systems.
- ◆ Transportation and other urban infrastructure that is cost effective and affordable.
- ◆ Elimination of hidden subsidies.
- ◆ Integrated transportation and land-use decision making.
- ◆ Development and use of appropriate technology that increases access to basic needs without the need for cars or other energy intensive motor transport.

Source: Transportation Association of Canada, *Urban Vision Sampler* (pamphlet) (Ottawa, February 1996).

Two contrasting vision statements, from the Transportation Association of Canada and the Canadian Urban Institute, illustrate the range of possible transportation system outcomes in Canada. Perhaps the most influential vision statement in Canada is *A New Vision for Urban Transportation in Canada* published in 1993 by the Urban Transportation Council of the Transportation Association of Canada (TAC). It has been widely endorsed by organizations such as the Federation of Canadian Municipalities, the Canadian Urban Transit Association, the Ontario Transportation and Climate Change Collaborative and some of Canada's largest municipalities. Exhibit 2.2 presents the TAC generic vision for urban transportation in the year 2023.

Exhibit 2.2

A Generic Vision for Urban Transportation in 2023 from the Transportation Association of Canada

- ◆ A long-term urban development plan has been approved. It emphasizes multi-use town centres and high density, mixed use along connecting corridors. Public transit has funding and operating priority in those corridors.
- ◆ Short- and medium-term community/neighbourhood plans have been approved. They emphasize compact, mixed-use communities based on walking, cycling and transit-friendly design.
- ◆ Transit, highways, arterials, parking and truck routes are planned and coordinated across the urban area.
- ◆ The percentages of trips made by walking, cycling, transit and high-occupancy cars are all increasing; the percentage of trips made by single-occupancy cars is decreasing.
- ◆ The average distance and time for peak hour commuter travel is decreasing.
- ◆ An area-wide parking strategy is in place and enforced.
- ◆ Few places still require on-street goods transfer.
- ◆ The physically challenged enjoy universal access to public transit and services.
- ◆ Roads and bridges are in good repair.
- ◆ Air pollution from motor vehicles is declining.
- ◆ Urban transportation infrastructure and services are adequately funded from stable and sustainable revenue sources.
- ◆ Political leaders have the support of a well-informed public when making decisions on urban development and transportation systems to serve the area.

Source: Transportation Association of Canada, *Urban Vision Sampler* (pamphlet) (Ottawa, February 1996).

The Canadian Urban Institute, in its 1994 study *Cities Without Cars*, presented a substantially different approach to sustainable transportation. Starting from the assumption that sustainable transportation requires cities without cars, two teams of land-use and transportation planners from Toronto and Vancouver envisioned what their regions would be like if use of personal automobiles was gradually phased out by 2032 and 2021 respectively. These visions are not easily summarized, and interested readers are directed to the study for further information.

Initially, *Cities Without Cars* was a visioning exercise “in which one of several possible futures [was] assumed for the purpose of securing fresh perspectives on the present.” After initial scepticism, the teams concluded that the cities without cars scenario is “desirable, feasible and even necessary.” This is a valuable insight for anyone working toward sustainable transportation. Visioning is a powerful tool to “break out of existing moulds and methods to permit the development of new paradigms.”²⁹ Given how deeply ingrained current transportation patterns are in our lifestyles, psyches and institutions, new ways of thinking are essential to create a sustainable transportation system.

No long-term vision of sustainable transportation has yet been embraced by the Government of Canada or any provincial government.

Definitions of Sustainable Transportation

Despite the voluminous literature on sustainable transportation, there are surprisingly few formal definitions of the term. Nonetheless, it is clear that definitions of sustainable transportation derive from the definition of sustainable development. As conceived by the Brundtland Commission in 1983, sustainable development is “development which meets the needs of the present without compromising the ability of future generations to meet their own needs.” Subsequent elaborations have refined and expanded this definition to encompass a range of environmental, social and economic issues. Analogous ideas are found in the definitions of sustainable transportation listed in Exhibit 2.3.

Selected Definitions of Sustainable Transportation

Environmentally sustainable transportation is transportation that does not endanger public health or ecosystems and meets mobility needs consistent with:

- ◆ the use of renewable resources at below their rates of regeneration; and
- ◆ the use of non-renewable resources at below the rates of development of renewable substitutes.

Source: Organization for Economic Cooperation and Development, *Environmental Criteria for Sustainable Transportation* (Paris, 1996).

In economic terms a sustainable transportation system will have to optimize infrastructure, labour, capital operating costs, and logistics costs and benefits. In social terms it will have to reduce noise, decrease accidents, including the environmental impacts of transportation accidents, and to reduce travel time and the associated stress and frustration arising from, for example, congestion. In environmental terms it will have to reduce and/or eliminate air, land and water pollution; and it will have to apply reduce, reuse and recycle strategies to decrease waste. In the area of urban transportation, mixed use and higher density urban land-use and zoning policies will enable the development of transportation systems which will provide an optimal balance between people's and freight shippers' needs for access to transportation services and mobility, healthy communities, and more sustainable transportation services.

Source: D. Bell, R. Delaney and R. Lewis, *A Proposal for Sustainable Transportation — A National Framework* (Ottawa: Transport Canada, 1996).

Sustainable transportation is a transportation system that is:

- ◆ capable of delivering required capacity and performance;
- ◆ renewable, which ultimately means using solar energy, or failing this a relatively inexhaustible energy source such as nuclear fusion;
- ◆ compatible with the kinds of places we want to live in;
- ◆ clean, so that environmental quality is maintained or enhanced; and
- ◆ affordable in terms of capital and operating/maintenance costs.

Source: IBI Group, *Full Cost Transportation and Cost-Based Pricing Strategies* (Toronto: Transportation and Climate Change Collaborative, November 1995).

Sustainable transportation entails elements of several visions. These visions include changing people and the way they live, changing prices and changing technology.

“Changing people and how they live” means reducing the need for transportation, premised on the belief that automobile vehicle miles travelled are a destructive ecological force.

“Changing prices” means modifying transportation demand through the use of market forces to enhance system wide transportation efficiency. The role of public policy, in this vision, is to send the right signals to the economy to make the marketplace work for instead of against sustainable development and ecological integrity.

“Changing technology” means employing appropriate technologies to reduce the impact of transportation on society.

Source: D. Gordon, *Transportation and Energy: Sustainable Transportation and How We Get There* (Washington, D.C.: American Council for an Energy-Efficient Economy, 1995).

A sustainable transportation system:

- 1 meets the access needs (transportation capacity and performance for people and goods) of the present generation;
- 2 allows all future generations to meet their own access needs (which will grow because of economic growth and rising populations);
- 3 is powered by renewable (inexhaustible) energy sources;
- 4 does not pollute air, land or water beyond the planet’s ability to absorb/cleanse (especially CO₂);
- 5 is technologically possible;
- 6 is economically and financially affordable;
- 7 supports a desirable quality of life;
- 8 supports local, national and global sustainable development goals.

Source: J. Hartman, Transportation Association of Canada, presentation to Environment Canada retreat at Econiche House, 1995.

Decision-Making Principles for Sustainable Transportation

One of the basic barriers to progress toward sustainable transportation is current decision-making principles. In particular, (1) there is no central oversight to ensure that, together, the decisions made create the transportation system we want (whatever that may look like); and (2) some of the key decision-making principles now in use work against sustainability.

Achieving sustainable transportation requires changes in the way transportation decisions are made by individuals and governments. Within the literature, there are calls for changes to:

- Educate the public about the risks of inaction and the potential benefits of shifting to sustainable development and sustainable transportation approaches.
- Integrate environmental objectives fully into transportation policies.
- Integrate land-use and transportation policies so that transportation responds to desired land use and urban form.
- Shift the emphasis in transportation systems from mobility to accessibility, to minimize the need for motor transportation.
- Ensure that transportation decisions of individuals, business and governments take full account of the external costs of such decisions.³⁰
- Use economic instruments more aggressively to achieve specific environmental, economic and social targets when fuller cost pricing (which “internalizes” external costs) is inadequate to achieve sustainability.
- Think creatively about our vision of the future, without being constrained by current transportation or urban settlement practices.
- Provide accessibility/mobility alternatives in parallel with measures to reduce the availability of high external cost transportation infrastructure and services, such as road or air transportation.
- Look for the environmental, social and economic benefits to society and to individuals from transportation practices that meet the test of sustainability.
- Ensure flexibility in policy development and implementation for sustainable transportation by adopting integrated packages of policy measures that can be altered to reflect experience gained from new approaches.

Appendix C lists decision-making principles that have emerged from the Transportation Association of Canada, the International Council for Local Environmental Initiatives, Transport Canada, Canada's National Action Program on Climate Change (1995) and the National Round Table on the Environment and the

Economy. The NRTEE's set of principles was presented at the OECD conference, Towards Sustainable Transportation, held in Vancouver in March 1996, and was later modified by Environment Canada.

Quantifiable Performance Measures

Quantifiable performance measures are essential to provide a baseline for tracking the sustainability of the transportation system as it evolves, and measuring the contribution of policy instruments to achieving goals and targets.

A paper by Transport Canada staff suggests performance measures of progress toward achieving four "strategic objectives":

- To meet Canadians' needs for access to safe, efficient and affordable transportation services.
- To achieve continuous improvements in the sustainable use of resources through measures to increase transportation efficiency, improve stewardship and enhance waste management.
- To respect ecosystem integrity.
- To promote more sustainable transportation in Canada and abroad.³¹

Other sources of performance measures focus on the environmental impacts of transportation. For example, Environment Canada has developed environmental indicators for Canadian passenger transportation based on the following series of interrelated factors:

- Human activity: how Canadians travel (passenger-kilometres by mode).
- Stress: fossil fuel use by automobiles (litres consumed).
- Environmental conditions: climate change, urban air quality, stratospheric ozone depletion, etc.
- Societal response: urban transit and automobile use (passenger-kilometres).

The OECD Pollution Prevention and Control Task Group on Transport has also proposed six quantitative criteria for environmentally sustainable transportation, namely: emissions of nitrogen oxides; emissions of volatile organic compounds; emissions of particulates; emissions of greenhouse gases; land in use for motor transport; and noise levels.

A report for the U.S. Environmental Protection Agency provides a more comprehensive list of performance measures.³² For all modes, quantifiable measures are provided for environmental effects relating to infrastructure construction and maintenance; vehicle and parts manufacture; vehicle travel; vehicle maintenance and support; and vehicle and parts disposal.

Indicators of urban sustainability overlap with indicators of transportation sustainability. For example, a 1995 workshop sponsored by Canada Mortgage and Housing Corporation and Environment Canada identified a wide range of urban sustainability indicators that relate to transportation, including:

- Land use/urbanization: density, mixed use, urban form.
- Energy consumption: per capita consumption.
- Transportation: modal splits, infrastructure expenditures, commuting distance/time mode, vehicle-kilometres, energy consumed, pollution produced.³³

Several observations can be made about the search for performance indicators. First, sustainable transportation has many facets, each of which could be measured using a variety of indicators. Prioritization may be necessary to avoid unwieldy data collection and manipulation. Tracking accessibility or safety performance may be less important than environmental performance.

Second, transportation has many environmental effects, not all of which are equal in importance. Prioritization will likely be necessary here. For example, tracking highway runoff may be less important than tracking air quality measures.

Third, it may be possible to use “reference indicators” that represent a group of effects. For example, emissions of a pollutant that are strongly correlated with emissions of other pollutants may be a suitable reference indicator for that entire group of pollutants.

Objectives and Strategies for Sustainable Transportation

Existing objectives and strategies relating to sustainable transportation focus almost exclusively on sustainability from an environmental perspective. For example, for transportation to be environmentally sustainable in 2030, the OECD suggests the following goals:

- Transport-related nitrogen oxide emissions are reduced to meet objectives for ambient nitrogen dioxide and for ozone levels as well as for nitrogen deposition.
- Volatile organic compound emissions are reduced to the extent necessary to avoid excessive ozone levels.
- Emissions of particulates are reduced to the extent necessary to avoid harmful ambient air levels.
- Climate change is prevented by achieving per capita carbon dioxide emissions from fossil fuel use that are consistent with the global protection goals for the atmosphere.
- Land surface in urban areas is used for the movement, maintenance, and storage of motor vehicles (including transport vehicles) in a way that meets objectives for ecosystem protection and maintains a high degree of mixed-use urban structure.

- Transportation does not create excessive outdoor noise levels that present a health concern or serious nuisance.³⁴

The OECD argues that, from the perspective of the 1990s, these objectives seem to be the most comprehensive and relevant. However, they should be reviewed frequently and adjusted accordingly.

The Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) says that stabilizing carbon dioxide concentrations at near current levels would require reducing worldwide carbon dioxide emissions immediately by 50 to 70 percent, with further reductions thereafter. Other authors have argued that reductions of 80 percent or more per capita should be achieved in industrialized countries to allow for increases in emissions in countries currently responsible for very low levels of emissions.³⁵

These are challenging targets, which have profound implications for transportation systems. OECD countries have committed themselves to much more modest goals. Most countries have committed to stabilizing transportation-related greenhouse gas emissions at 1990 levels by 2000. Austria, Denmark, Germany and the Netherlands have committed to reductions of between 10 and 25 percent to be achieved in later years. The OECD indicates that many countries are reporting difficulty meeting even these modest targets.

The international situation, however, could change quickly. In December 1997, the Third Conference of the Parties to the United Nations Framework Convention on Climate Change will be held in Kyoto, Japan. At the Second Conference of the Parties in Geneva, Switzerland in July 1996, the U.S. Undersecretary for Global Affairs, Timothy Wirth, indicated the United States has formally accepted the science on climate change. He also presented the U.S. proposal that legally binding emission targets be adopted by the international community in Kyoto, and that, during the meeting, the developed countries should endorse an international system of emissions trading. Such a protocol, if adopted, would likely have major economic implications for Canada.

Policy development for sustainable transportation in Canada is not being carried out in an atmosphere of crisis. Canada continues to work to harmonize its national ground level air quality standards and emissions regulations with those of the international community. Canada embraces the air quality guidelines of the World Health Organization, and the transportation vehicle emissions standards of the United States.

Canada has committed itself only to stabilizing greenhouse gas emissions at 1990 levels by the year 2000, and is unlikely to meet even that modest target. Canada's National Action Program on Climate Change (1995) (NAPCC) does not set out specific objectives for reducing greenhouse gases from the transportation sector. While it does summarize the activities of various government departments that are expected to help reduce greenhouse gases, it does not indicate the quantitative gains expected from these activities.

To bring carbon dioxide emissions from transportation in Canada into line with the reductions recommended by the IPCC would require far more aggressive policy measures and changes in societal behaviour than any so far in place or under serious consideration by governments in Canada.

However, the situation could change substantially in the relatively near future. Municipal and provincial thinking about urban transportation in Canada today is driven almost exclusively by the new reality of shrinking budgets. This may be serendipitous, because some proposals for new revenue sources, such as roadway congestion pricing and user fees and tolls, can have positive environmental impacts by shifting auto demand to other times and other modes. We seem to be at a unique point in history when economic and environmental goals in urban transportation may converge, with major implications for sustainability.

British Columbia has perhaps the most developed clean air strategy based on three complementary policy objectives:

- Reducing the need for transportation through such actions as land-use planning and telecommuting.
- Encouraging alternatives to the automobile such as public transit, carpooling and cycling.
- Reducing emissions per vehicle-kilometre through the use of cleaner vehicles and fuels.

British Columbia has not published estimates of the impacts of these measures or set specific targets for reducing carbon dioxide emissions. It has, however, expressed its intent to support Canada's commitment to reduce greenhouse gas emissions to 1990 levels by the year 2000, and to examine sustainable approaches to further reductions.³⁶ British Columbia has also pushed to adopt the stringent emissions standards of California.

The Ontario Transportation and Climate Change Collaborative, which was jointly sponsored by the NRTEE, the Ontario Round Table on the Environment and Economy and other groups, has proposed a 12-point strategy for sustainable transportation (Exhibit 2.4). This strategy has not been formally endorsed by the Government of Ontario.

A Recommended Strategy for Sustainable Transportation in Ontario

- ◆ Design and implement a broad range of programs to ensure that the public understands the risks of climate change and the need to economize on the use of fossil fuels.
- ◆ Implement policies that will bring about more compact, mixed-use development in urban areas to shorten travel distances and reduce vehicular travel demand.
- ◆ Establish decision-making bodies in large urban areas to evaluate, plan and deliver integrated transportation and urban development, as well as integration of transit systems and services.
- ◆ Implement transit priority measures to make transit time competitive with automobile travel.
- ◆ Maintain sufficient funding to ensure adequate transit funding capacity, increase the acceptability of using funds from user-pay sources to improve public transit and enhance transit service in areas with sufficient population density.
- ◆ Implement pricing and supply policies to control parking and encourage transfer to transit.
- ◆ Implement fuller cost pricing for transportation modes to discourage overuse of single-occupancy vehicles and encourage the use of more fuel-efficient technologies and transportation modes.
- ◆ Develop a Memorandum of Understanding with automotive manufacturers to increase the availability of fuel-efficient models, recognizing the linkage between gasoline prices and consumer demand for more fuel-efficient vehicles.
- ◆ Implement mandatory vehicle inspection and maintenance programs in large urban areas to ensure the proper operation of emission control equipment.
- ◆ Maintain incentives for the use of cleaner alternative fuels and explore ways to promote further the development and use of alternative fuelled vehicles.
- ◆ Develop an Ontario capability to participate in the U.S. government's and the Big Three auto manufacturers' Partnership for a New Generation of Vehicles (PNGV). The PNGV is working to develop vehicles that will achieve a threefold increase in fuel efficiency over today's vehicles, while maintaining size, performance utility and safety.
- ◆ Enhance intermodal freight transfer facilities and services and encourage the development of new intermodal technologies and service levels.

Source: Transportation and Climate Change Collaborative, *A Strategy for Sustainable Transportation in Ontario* (Toronto, November 1995), pp. 6-7.

Jurisdictional Roles and Activities

Every level of government has several important roles to play in achieving sustainable transportation. The following discussion summarizes some of the key responsibilities and initiatives in different jurisdictions and identifies some of the more important interjurisdictional issues raised in the literature.

International Bodies

Bodies such as the United Nations set international goals for sustainability. The most important of these related to transportation are the 1988 Montreal Protocol on stratospheric ozone depleting substances, the 1992 Framework Convention on Climate Change, and the 1996 Istanbul Declaration on Sustainable Human Settlement. The latter was the outcome of Habitat II, the United Nations Conference on Sustainable Human Settlements.

The OECD has been a strong player in the research, education and awareness, and policy development aspects of sustainable transportation. It has published the results of many of its studies and disseminated the practical experience of many countries. It has also influenced policy making for transportation, particularly in the European Community.

Federal Government

The Canadian government's key responsibilities in the achievement of sustainable transportation include:

- Canada's contribution to the development, negotiation of and commitment to international protocols related to sustainable development and sustainable transportation.
- Programs of public education and awareness.
- Monitoring and evaluating performance against national air quality standards, including health effects and impacts on ecosystems.
- National energy policy including measures promoting the use of lower carbon content fuels than gasoline and diesel, and standards for cleaner fuels.
- Developing technologies contributing to reduced fuel use and reduced need for transportation.
- Regulating vehicle emissions standards, with particular attention to harmonization with the United States and dealing with transboundary air and water pollution.
- Regulating vehicle safety standards.
- Regulating vehicle fuel efficiency standards, including harmonization with U.S. standards.

- Harmonizing sustainable transportation strategies and actions with other governments, particularly the United States, to ensure Canada remains economically competitive with other jurisdictions.
- Using its taxation powers to apply economic instruments in ways that internalize external costs of transportation or to meet specific environmental, economic and social objectives, by changing consumer and business behaviour. In particular, fuel tax and income tax levers could be adapted to meet sustainability objectives.
- Implementing policies that improve the energy efficiency and environmental performance of its own transportation fleets.

The federal government plays a key role in national initiatives such as the NOx/VOC Management Plan and Canada's National Action Program on Climate Change (NAPCC). Strictly federal initiatives include the newly established Commissioner of Environment and Sustainable Development, the Ozone Depleting Substances Plan and the federal FleetWise program.

Despite these initiatives, it is clear that we are far from acceptable levels of certain air pollutants. There is much more yet to do. Further, it is apparent that science has much more to tell us in future about the impacts of a broad range of pollutants, including those currently being addressed by policy makers and those that are not now the subject of policy focus.

Canada's NAPCC does not yet contain specific targets for the transportation sector. Moreover, there is no indication that the impact of the program's transportation measures will enable Canada to meet its commitment to stabilize carbon dioxide emissions at 1990 levels by the year 2000. The Voluntary Challenge and Registry (VCR) is the main national initiative under the NAPCC. The VCR is in its early stages of development with about 600 organizations — mainly large corporations and government bodies — signed up. In its present form it is unlikely to have a major impact on transportation, since it does not address individuals or small and medium-sized enterprises, the source of the majority of carbon dioxide emissions from transportation. The federal and provincial sponsors of the VCR intend to expand its reach to include a much broader range of organizations. In October 1996, the Board of Directors of the Transportation Association of Canada endorsed the VCR. The TAC will now encourage its members, including provincial departments of transportation that may or may not have been involved in earlier submissions to the VCR from environmental and energy ministries, to sign on.

Canada's NAPCC is silent on the need for integrated packages of policies for achieving sustainable transportation, despite extensive international attention to this approach. The program is also silent on government use of economic instruments, including fuel taxes, to promote long-term changes in market behaviour that could help in achieving sustainable transportation. In its present form, the transportation section of the program is not a strategy with an expected outcome. It is a list of Canadian initiatives that may have an (unspecified) impact on sustainability.

Provincial Governments

The provinces have jurisdiction over land-use planning, an activity that may play a key role in working toward long-term sustainability in transportation. Currently, each province has its own approach to land-use planning. In general, however, most provinces vest most land-use responsibilities at the municipal level. This tends to reduce the ability to achieve higher density, mixed-use communities, as municipal governments are highly susceptible to NIMBY opposition from local homeowners.

Provincial governments also play a large role in transportation decision making. Provincial responsibilities include capital and maintenance costs of road infrastructure and public transit, the registration and licensing of vehicles, fuel taxes, safety, policing and regulation of the insurance industry.

Some provinces have initiated programs targeted at sustainable transportation. The following examples illustrate the range of responsibilities and potential roles for provincial governments.

British Columbia has a Clean Vehicles and Fuels Program. It expects this policy to result in air quality levels in the Lower Fraser Valley that are similar in 2020 to what they are now, despite the projected growth in vehicle use in that period. The range of initiatives under consideration in the Clean Vehicles and Fuels Program include:

- Improved emissions test levels and manufacturer emission performance warranties.
- A heavy duty vehicle inspection program for trucks and buses.
- A voluntary scrap program for highly polluting vehicles.
- Encouragement of natural gas and propane vehicle conversions and requirement that converted vehicles meet low emission standards.
- B.C. low emission standards (similar to California standards), encouraging low and zero emission, fuel efficient and alternative-fuelled vehicles.
- Encouragement of original equipment manufacturer (OEM) manufacture of alternative-fuelled vehicles, especially for fleet and heavy duty applications.
- Government fleet changes and demonstration programs.
- Emissions labelling of new vehicles.
- Cleaner diesel fuel, including improved diesel performance and diesel fuel standards for off-road markets.
- Cleaner gasoline, including the Canadian Government Standards Board gasoline standard, minimum detergent standards, and the elimination of methylcyclopentadienyl manganese tricarbonyl (MMT).
- Gasoline vapour pressure controls, including reduction of allowable vapour pressure in gasoline in summer and extending the application of vapour pressure reduction to areas outside the Lower Fraser Valley.

- Reformulated gasoline.
- Renewable alternative fuels such as ethanol, ethyl tertiary butyl ether (ETBE) and methyl tertiary butyl ether (MTBE) as gasoline additives.
- Tax relief for alternative transportation fuels, including natural gas, propane and methanol.
- Stage I and II gasoline vapour recovery in the Lower Fraser Valley.

Ontario, in addition to its participation in the national NOx/VOC Management Plan, is “pursuing initiatives that will address emissions originating in the transportation sector”³⁷ Among the newer initiatives is the evaluation of the results of the pilot inspection and maintenance (I&M) program that has been in operation in Metro Toronto for the past year. The government recently announced plans for a mandatory I&M program in Ontario, with details still pending. The government has estimated that a program for the Greater Toronto Area (GTA), in addition to reducing ground level pollutants, would reduce carbon dioxide emissions by 400 kilotonnes a year, or by about 1 percent of total emissions from transportation in Ontario.

Ontario is currently developing a smog management plan, aimed at reducing ground level ozone and particulates. It should be noted that international work on this issue is important to Canada, since approximately 50 percent of such emissions in Eastern Canada come from the United States.

The province has begun development of a GTA Transportation Plan in cooperation with the regional municipalities within the city-region. “The plan is to ensure that appropriate choices are made in transportation investments to yield optimum benefits for the community, the environment and the economy. The plan will address the requirements associated with the preservation and rehabilitation of existing infrastructure, as well as opportunities for optimizing the use of existing facilities. Opportunities for selective expansion of the transportation network will also be assessed.”³⁸

Statements describing the new GTA Transportation Plan are not clear on how meeting forecast demand for transportation and the new objectives of sustainability and more compact urban form will be realized. The following statement suggests that the traditional model of demand-responsive transportation planning may still be driving the effort:

The dynamic growth of population and employment in Halton, Peel, York and Durham will result in significant travel increases within these regions.

Their city centres and development nodes will attract many new trips. Other major trip destinations will include large industrial parks and low density commercial development. As a result, outbound commuters from Metro will also form an important and growing component of future travel demand.³⁹

On the other hand, the document also contains statements such as:

Significant advances in terms of integrating land use and transportation decisions at the Official Plan level have been made by regional and provincial governments. An urban structure concept consisting of designated transit supported centres and corridors has been endorsed for future development.⁴⁰

Nothing in the public documents describing the GTA Transportation Plan suggests the plan will be based on any particular environmental objective. Among the five objectives of the plan is the following: “Support the goals of sustainable urban development and transportation in the GTA by taking a balanced approach to social, economic and environmental issues.”⁴¹

On the surface this does not appear to be a commitment to sustainable transportation, which requires at a minimum substantial reductions in transportation energy consumption. In the same document, however, is the following statement as part of “A Transportation Vision for the GTA”: “[The Plan] respects the environment by reducing the impact of harmful emissions through declining use of single occupancy vehicles, and by taking pressure off green-fields development.”⁴²

At this stage it is not possible to assess the likely contribution of the GTA Transportation Plan to sustainable transportation in Canada, since the project is not complete. However, because major long-term planning efforts such as the GTA Transportation Plan are infrequent, the directions the Ontario government and the regional municipalities take now in developing and implementing land-use and transportation plans for the GTA could have a profound effect on the sustainability of transportation in Canada’s largest city-region for decades to come.

In Quebec, a multimodal transportation plan is under development for the province and 10 regions, and a truck route network has already been established to minimize urban congestion and road deterioration. Since 1993, provincial law has required regional municipalities to integrate transportation planning into municipal planning. To assist municipalities in implementing this provision, the Ministry for Municipalities has created a transportation planning guide for municipalities.

The Quebec Ministry of Transportation has taken the lead in developing a long-range transportation plan for the Montreal urban region, which embraces about 135 municipalities. Priority is being given to optimizing the current transportation infrastructure and increasing the modal shift from automobiles to public transit through transportation demand management measures. The major objectives are to improve air quality as well as traffic flow in the region. One of the main factors driving the push for an increasing modal share for public transit is the fact that continuing auto dependence would require construction of several costly new bridges to access Montreal Island.

At the end of 1995, the Government of Quebec created a regional transportation agency for the Montreal region to address transit and related transportation needs in the Greater Montreal Region. The new agency will have broader powers than the former regional transit agency, the City of Montreal Transit Commission. The new agency has been created to foster a comprehensive approach to transportation throughout the region. It will have planning powers related to both transit and road

infrastructure. It will also have dedicated sources of revenue that it will use to provide financial assistance for transit services offered on the regional public transit network. The three existing major transit systems in the Montreal region will continue to function in collaboration with the new agency.

The concept of sustainable transportation is not explicit in the transportation plan for the Montreal region. However, moves toward financial sustainability are implied by the priorities established within the plan. If the plan and the new institutional arrangement described above are successfully implemented, there should be progress toward environmental sustainability of transportation in the region.

Regional and Municipal Governments

As recognition grows that sustainable transportation will require significant changes to travel patterns, regional and municipal governments are becoming key players in efforts toward sustainable transportation. For example, the Federation of Canadian Municipalities cosponsors the 20% Club, whose 130 or more municipal members have committed to actions on climate change. Six of Canada's largest municipalities have committed to reduce greenhouse gas emissions by 20 percent from 1990 levels by 2005.⁴³ Reductions are coming from transportation, energy consumption, landfill methane recovery, urban forestation and other activities.

One clear municipal role in working toward sustainable transportation is land-use planning to encourage higher density, mixed-use communities. However, municipalities have many other roles to play. In February 1996, the Transportation Association of Canada published an *Urban Vision Sampler*, which highlights sustainable transportation efforts by eight municipalities. These cover a broad range of strategies and individual measures and plans for improving the environmental, social and economic impacts of local transportation. Most frequently, municipal efforts relate to traffic demand management; public transit services; cycling infrastructure; pedestrian infrastructure; parking policies; and "greening" of municipal fleets. For example, Montreal has adopted an official plan and an urban transportation policy that includes the following items:

- A network of 130 kilometres of bicycle paths.
- Pedestrian infrastructure such as underground walkways in the city core and pedestrian priority signals.
- Intermodal parking at metro stations.⁴⁴
- A private parking policy that discourages long-term parking downtown, provides street-reserved parking for residents and uses tax policy to discourage transformation of vacant land into outdoor parking.
- A green fleets program that involved joining a program of the International Council for Local Environmental Initiatives to reduce urban transportation energy consumption.

The approach in the Greater Vancouver Regional District is based on three complementary initiatives:

- The Liveable Region Strategic Plan, which provides a land-use plan including compact mixed-use communities and increased transportation choice.
- Transport 2021, which provides long- and medium-term transportation plans based on desired urban form and priorities for walking, cycling, public transit, goods movement and then the automobile.
- The Air Quality Management Plan, which provides controls on many sources of air pollution including transportation.

The Regional Municipality of Ottawa-Carleton (RMOC) has adopted two vision documents as the basis for decision making related to development of its transportation system:⁴⁵

- Ottawa-Carleton's Community Vision: a region of communities that are environmentally healthy, safe, caring, prosperous and diverse.
- The Transportation Association of Canada's Urban Transportation Vision.

The RMOC has adapted the generic TAC vision and decision principles to address the unique issues and needs of the Ottawa-Carleton region. Public consultations in the region have identified key concerns that have particular relevance to sustainable transportation. For example:

- There is a desire for increased opportunity to walk and cycle.
- Many residents feel dependence on the automobile needs to be reduced.
- There is support for improved transit service.
- Environment was ranked as a number one priority by those surveyed during the RMOC community vision process, despite current economic conditions.

An overall Transportation Vision statement was developed to encompass all of the principles adopted for the region: "Ottawa-Carleton will be a model region in promoting effective, affordable and accessible transportation emphasizing an increased use of public transit and other environmentally friendly modes such as walking and cycling."

In February 1993, the Council of the Regional Municipality of Hamilton-Wentworth adopted a vision statement and implementation report, entitled *Vision 2020: The Sustainable Region*, as a basis for all regional decision making. Vision 2020 was premised on the need to consider broader linkages among the economy, the environment and health/social factors, if a sustainable community is to be realized. Transportation, land-use and other planning and program development in the region are all under way using the goals and principles adopted for Vision 2020.

Hamilton-Wentworth is Canada's designated community participating in the United Nation's Local Agenda 21 Model Communities Program (MCP). The MCP is a three-year research and development collaboration in which 14 municipalities from around the world are developing tools and models for local sustainable development planning. Transportation is a key element, with emphasis on new land-use policies, walking, cycling, transit, less reliance on automobiles and intermodal integration. The MCP is coordinated by the International Council for Local Environmental Initiatives.

Footnotes

29 Canadian Urban Institute, *Cities Without Cars* (Toronto, Vancouver, 1994), section on Greater Vancouver Regional District, p. 3.

30 External costs of transportation are costs to society that are not borne by users of transportation. These include costs of congestion, injury and death to others, social isolation of non-users, air and water pollution, solid waste and greenhouse gases.

31 D. Bell, R. Delaney and R. Lewis, *A Proposal for Sustainable Transportation — A National Framework* (Ottawa: Transport Canada, 1996).

32 Apogee Research, *Indicators of the Environmental Impacts of Transportation*, paper prepared for the U.S. Environmental Protection Agency, June 1996.

33 Lura Group, *Measuring Urban Sustainability: Canadian Indicators Workshop Proceedings* (Ottawa: Canada Mortgage and Housing Corporation and Environment Canada, 1996).

34 Organization for Economic Cooperation and Development, *Environmental Criteria for Sustainable Transportation* (Paris, 1996), p. 62.

35 Ibid., p. 59.

36 Ibid., p. 14.

37 Ontario Ministry of Environment and Energy, *Meeting the Challenge of Climate Change: A Status Report on Initiatives in Ontario to Reduce Greenhouse Gas Emissions* (Toronto, 1995).

38 Ibid.

39 Ontario Ministry of Transportation, *Towards a Greater Toronto Area Transportation Plan: The Challenges* (brochure) (Toronto, 1995), p. 4.

40 Ibid., p. 8.

41 Ibid.

42 Ibid., p. 7.

43 Federation of Canadian Municipalities, *The 20% Solution: A Municipal Approach to Addressing Climate Change* (brochure) (Ottawa, n.d.), p. 6.

44 Intermodal parking is located at transit stations to enable motorists to use public transit for a portion of their trip.

45 Regional Municipality of Ottawa-Carleton, *Transportation Master Plan — Transportation Vision, Principles and Issues*, approved by Regional Council, October 25, 1995.



**Policy Options
and Associated
Jurisdiction and
Timing Issues**

Where is Sustainable Transportation on the Policy Development Agenda?

Policy development for sustainable transportation is, in a phrase, just out of the starting gate. The essence of the challenge faced in transportation was expressed by Professor William Rees of the University of British Columbia in a presentation to the National Conference on Sustainable Transportation, in Vancouver in November 1995.

It seems that humankind, thoroughly alienated from nature, is set on an unsustainable course which certainly degrades the natural “environment” and which could plausibly end with the ecological razing of the Earth. As Cambridge economist Terry Barker (1994) points out, this sobering conclusion “... is not that of a ‘deep green’ minority. It is the scientific, political and economic consensus as expressed by the UN Intergovernmental Panel on Climate Change, the Brundtland Report, the (UN) Conference on Environment and Development in Rio de Janeiro, the Business Council for Sustainable Development, and the World Resources Institute.”⁴⁶

Despite major technological advances in the past two decades in all modes of transportation, transportation remains the fastest growing sector in terms of a broad range of negative environmental, social and economic impacts. Moreover, despite reductions in some air pollutants in recent years, as a result of the coordinated actions of governments and industry, smog, particulates, sulphates and air toxics are continuing problems.

Policy responses by governments, at least in North America, continue to focus on combinations of regulation and technology policy options in the technology sector. Few steps have been taken to implement stronger packages of policies that can affect a broad range of consumer and business decisions.

Governments are financially constrained and can no longer base infrastructure investment decisions primarily on demand growth by individual mode. A current example at the municipal and provincial levels is the decision in Ontario to continue construction of the Sheppard subway line in Metro Toronto, where opportunities for more cost-effective alternatives were not widely debated. More effort is required in evaluating the most cost-effective transportation alternatives and in accounting for externalities.

There are, however, many signs of change in the way decisions are being made. Regional metropolitan governments in all parts of Canada are beginning to rethink the way urban transportation systems will be developed in future to support new land-use planning approaches. The Federation of Canadian Municipalities and some individual municipalities have adopted the generic vision and principles for urban transportation articulated by the Transportation Association of Canada. While the TAC acknowledges that the approaches it advocates will not lead to true sustainability, they are steps in the right direction.

However, Canadian efforts have not coalesced into a well-formed national strategy and broad consensus on a set of integrated actions for tackling urban sustainability. So far, there has been little attention to the sustainability of intercity freight movement, and little action to address the aviation and marine modes.

Climate change is essentially in its infancy as an area for policy making. Specific targets have not yet been set beyond stabilizing emissions of greenhouse gases at 1990 levels. Canada does not have policies in place that would ensure transportation could meet this modest goal. Yet there are strong indications that much more aggressive and legally binding post-2000 emissions targets will be the subject of negotiations at the December 1997 Third Conference of the Parties (COP3) of the U.N. Framework Convention on Climate Change. Canada could be vulnerable economically if it does not address the issue as seriously as other countries in the international community.

Recent protocols of the United Nations, to which Canada is a signatory, have focused international attention on the policy directions required if sustainable development, including sustainable transportation, is to be achieved. Habitat II and the U.N. Conference on Sustainable Development in Rio are the most recent expressions of the beginnings of a global commitment to policies for sustainability.

New organizations such as the International Council for Local Environmental Initiatives (ICLEI), created in 1990, are becoming a force in the local sustainability movement. Toronto-based ICLEI now has about 200 member municipalities worldwide and expects its growth to continue.²⁴⁷ By 1995, 15 Canadian municipal governments had become members of ICLEI.

As stated in Chapter 2, the OECD has been an active participant in sustainable transportation research and policy development. It has sponsored international conferences on the subject, the latest being Towards Sustainable Transportation, a conference hosted by the Government of Canada in Vancouver in March 1996.

In 1994, the OECD and the European Conference of Ministers of Transport endorsed a comprehensive strategy approach to sustainable urban transportation. This strategic framework is one of the most advanced proposed to date. It will be used by European national governments as they develop their own policy responses. It could also be used as a starting model for a comprehensive strategy, at least for dealing with the challenges for urban Canada. This integrated strategy approach is discussed further in the section "Integrated Policy: The European Approach."

In the United States, moves toward sustainable transportation are rooted in a strong legislative framework that includes the Clean Air Act Amendments (CAAA) of 1990 and the Intermodal Surface Transportation Act of 1991. However, it has been noted by U.S. analysts that the clear targets for ground level air quality in the CAAA are driving transportation decision making in the U.S. and that societal and sustainability goals, including response to the climate change issue, are not incorporated into project or program evaluations of either act.

In conclusion, although a number of initiatives are contributing toward sustainable transportation in Canada, no focused strategy or program yet exists to ensure that an outcome of sustainable transportation can be achieved.

What Has Worked and What Has Not

What Has Worked

With the exception of ground level ozone, coefficient of haze and nitrogen oxide, urban air quality in Canada has benefited from reductions in emissions of some pollutants in the past 25 years. Progress has been made in acid deposition from air pollutants. Annual mean concentrations of sulphur dioxide, nitrogen dioxide and carbon monoxide and volatile organic compounds have all declined. Particulate lead has declined by 96 percent since 1974 because of the ban on lead in gasoline. Total suspended particulates have also declined, although this measure is now understood not to be a good indicator of health effects or pollution sources. Particulates, in fact, remain an area of concern.⁴⁸

Routine monitoring results from the National Air Pollution Surveillance (NAPS) network for the period 1970-1994 are shown in Exhibit 3.1. The NAPS network consists of air monitoring stations in most Canadian cities with populations greater than 100,000. The NAPS data represent pollution levels at individual sampling sites and may not necessarily represent community-wide air quality.

Summary of Seven Air Pollutants Measured by the NAPS Network

Pollutant	1990 Annual Mean Concentration	Percent Decline	Percent Decline
		1981-1990	1974-1990
Sulphur dioxide	6 ppb	21	53
Nitrogen dioxide	21 ppb	8	26
Carbon monoxide	0.8 ppm	45	67
Total suspended particulate	38 $\mu\text{g}/\text{m}^3$	34	51
Particulate lead	0.02 $\mu\text{g}/\text{m}^3$	93	96
Coefficient of haze	0.29 COH	no change	24
Ozone	18 ppb	+20	n/a

ppb = parts per billion; ppm = parts per million; $\mu\text{g}/\text{m}^3$ = micrograms per cubic metre; COH = coefficient of haze

Source: Pollution Probe, *Transportation, Air Quality and Human Health, Issues and Perspectives*, paper prepared for Health Canada, March 1996.

These improvements have resulted from changes in vehicle technologies and improved fuels developed in response to emissions standards imposed in the U.S. and Canada. Regulations to further tighten emissions standards continue to be implemented in both countries.

The federal and B.C. governments have been financially supporting Ballard Power Systems of Vancouver in its development of electric propulsion systems for transportation applications. Ballard is a world leader in the development of fuel cell technology, which is at the prototype/demonstration stage. If it can be successfully commercialized for broad application in transportation, the fuel cell could make important contributions to reducing air pollutant emissions. At present, however, it is not possible to predict how far the technology will penetrate the transportation market, and it would therefore be premature to attempt to predict the long-term impact of the technology on sustainable transportation.

In 1992, British Columbia introduced a mandatory inspection and maintenance program, called AirCare, for the one million light duty vehicles in the Lower Fraser Valley. Under this program, emissions of nitrogen oxides have been reduced by 3 percent, volatile organic compounds by 18 percent, and carbon monoxide by 24 percent. British Columbia is planning improvements to this program to increase its effectiveness, and also plans to introduce mandatory inspection and maintenance for heavy duty vehicles. For this latter initiative, the B.C. government has overwhelming public support.

Progress in reducing emissions of air pollutants from transportation has been the result of coordinated regulatory action by the federal and provincial governments, and agreements with vehicle manufacturing and fuel supply industries. Coordination has taken place through such mechanisms as the Canadian Council of Ministers of the Environment, Canadian Energy Ministers and the National Air Issues Coordinating Committee.

What Has Not Worked

National Level

In spite of the coordinating activities noted above, there is a general lack of integrated decision making about transportation issues among all levels of governments. Economics still drives most transportation decisions of the federal government. There is limited consideration of policies and programs designed to produce combined economic, environmental and social benefits, and so far little sense of urgency about sustainable development (including transportation) evident in the government's policies and programs.

Ground level ozone, inhalable and respirable particulates, and nitrogen dioxide continue to be of concern, particularly in view of emerging epidemiological evidence of their negative health impacts. As shown in Exhibit 3.1, ozone concentration has increased by about 20 percent since 1981.

Virtually all growth trends point to more frequent use of light duty vehicles with longer trips at lower speeds. Therefore, further gains in automobile emissions control will be required just to hold emissions at today's levels. (Note: stabilizing emissions at current levels appears to be the limited long-range goal of the current B.C. Policy on Clean Vehicles and Fuels.)

Since ground level ozone appears to be increasing and since epidemiological research is leading to increased concerns over the health effects of particulates (despite reductions in total suspended particulates over past decades), we must conclude that from a health perspective sustainable transportation has not been achieved. Moreover, the literature suggests that current policies are unlikely to result in sustainable transportation in future.

In 1994, the federal government announced a one-time increase in the excise tax on gasoline of 1.8 cents per litre. The tax was justified, at least in part, by its expected effect on automobile fuel consumption. Given the elasticities of demand for automotive fuels, it was clear from the outset that the new federal tax would have little impact on overall fuel consumption in Canada. In theory, the tax could reduce demand in the range of 1 percent. However, the increase was well within the range of short-term variations in the market price for the fuel.

In contrast, the British government in 1993, as one measure to meet its commitments for mitigating climate change, initiated a policy of increasing fuel taxes by a minimum of 5 percent in real terms per year, indefinitely.⁴⁹ This move was intended to send a strong and long-term signal to allow consumers, industry and governments to adjust a wide range of decision criteria and behaviours in the expectation of continuously rising fuel prices.

The OECD projects that a 7 percent annual real price increase would be required for the next 20 years, in combination with an integrated package of other instruments, to meet the IPCC target of a 60-80 percent decrease in greenhouse gas emissions.⁵⁰

The Voluntary Challenge and Registry, described in Chapter 2, is one of the principal initiatives of Canada's NAPCC. The future impact of the VCR on transportation energy demand in Canada is uncertain since the program does not yet involve a large percentage of transportation users.

To the extent that the oil and gas sector participates in it, the VCR could in theory contribute to life cycle reductions of greenhouse gas emissions from the transportation sector. However, it is not clear from reviews of the VCR that there will be reductions in greenhouse gas emissions from the extraction of crude oil and natural gas for the production of transportation fuels.^{51, 52}

Based on the plans of Imperial Oil, Canada's largest producer, SGA Consulting concludes that "the upstream oil production sector will become more energy intensive and greenhouse gas intensive in the future by virtue of the depletion of fossil fuel resources in the west. As conventional oil and bitumen (tar sands) reserves are depleted, more and more energy is expended trying to extract declining resources. For conventional oil production, processing and reinjection of increasing volumes of water produced along with the oil requires increased energy use per barrel of oil produced."⁵³ Exhibit 3.2, extracted from Imperial Oil's submission to the VCR, reflects these trends.

CO₂ Equivalent Emissions per Unit of Production from Imperial Oil Upstream Operations (tonnes/thousand bbl oil equivalent production)

Segment	1990	1994	2000
Conventional oil	14	16	18
Natural gas/NGL	30	30	30
Bitumen	64	67	69

Source: SGA Consulting, *An Analysis of Comprehensive Action Plans Received under the Canadian Voluntary Challenge and Registry Program* (Ottawa: Environment Canada, 1995), p. 2.

It was not possible, within this study, to determine whether Imperial Oil's projections are indicative of industry trends. New technologies may enable more efficient extraction for any of the three segments than is indicated in the exhibit. However, if future production shifts away from conventional oil toward oil sands, life cycle carbon dioxide emissions per unit of transportation energy consumption may increase. There appears to be a risk, therefore, that the increased energy intensity of oil extraction could reinforce the future growth of carbon dioxide emissions expected from increased consumption of transportation fuels. This is an area that warrants further investigation.

Provincial and Municipal Levels

In 1990, the Ontario government introduced a graduated feebate system called the Tax for Fuel Conservation (TFFC). This program taxes purchases of high fuel consuming vehicles. The tax ranges from \$75 to \$7,000 for vehicles with fuel economy ratings above 9 litres/100 kilometres. It also provides \$100 rebate for vehicles with fuel economy ratings below 6 litres/100 kilometres. For purchasers of the approximately 90 percent of vehicles falling within these two limits, a flat tax of \$75 applies. The TFFC thus provides an incentive to alter purchase decisions for about 10 percent of annual new vehicle sales. New vehicle sales represent approximately 8 percent of the on-the-road fleet in any given year. Therefore, the TFFC is likely to affect the fuel efficiency of less than 1 percent of the total vehicle fleet each year.

There is no mechanism to measure the impact of Ontario's TFFC program. However, in its November 1995 status report, *Meeting the Challenge of Climate Change*, the Ontario Ministry of Environment and Energy estimated that the program will reduce annual carbon dioxide emissions by 200 kilotonnes by the year 2000.⁵⁴ This would represent a reduction in fuel consumption from the Ontario fleet of approximately 0.5 percent of the projected transportation energy consumption in Ontario in that year. The TFFC has been estimated to raise between \$32 and \$55 million in tax revenue annually.⁵⁵

In a presentation to the Centre for Transportation Studies at the University of Minnesota in February 1995, Dr. Richard Soberman, then Chair of the Department of Civil Engineering at the University of Toronto, made important observations on what has worked and what has not worked in the development of urban transportation in the GTA. Some of his key remarks could apply to many major urban regions:

- Centralized controls on zoning during periods of rapid population growth encouraged high land-use densities along designated transit corridors within Metro Toronto. Outside Metro, residential and employment patterns that emerged in the absence of strong planning controls led to automobile-dependent urban sprawl.
- Had it not been for the intervention of the Ontario government in 1971, Toronto today would have had more expressways, a poorer transportation system, and less repute as a good place to live.
- The concept of balanced transportation does not work. If a plan really offers true choices between transit and automobiles, transit will not survive. (Note: this assumes automobile users do not pay the full costs of their use of urban land, roads and of air pollution.)
- Toronto's early successes with subway construction in obvious transit-intensive corridors led to attitudes that now preclude any serious consideration of less capital-intensive transit alternatives that may be more appropriate to emerging spatial patterns.
- Cost-based subsidy policies encourage transit inefficiency in all aspects of construction, operation and procurement.
- Although Toronto provides an example of the impact of transit investment on land use, expressways within and near Metro have had tremendous influence on patterns of land development as well.

Opportunities and Barriers

International efforts to develop effective approaches to sustainable transportation have until recently focused on regulation and reliance on technology fixes. It is no coincidence that the first few OECD conferences convened to address the widespread negative impacts of transportation focused primarily on technology and using regulation to force adoption of technologies to make vehicles cleaner and more fuel-efficient. Less attention has been paid to policies that reduce the need for transportation and encourage more efficient use of transportation facilities. There is now an opportunity to shift policy attention toward more holistic approaches to modifying values and behaviours in all sectors of Canadian society.

Clean air legislation and North American introduction of Corporate Average Fleet Efficiency/Corporate Average Fuel Consumption Standards led to improved fuel efficiency of new cars and, to a more limited extent, new light duty trucks in the 1970s and up to the mid-1980s. While these standards helped to constrain growth in fuel

consumption across the continent, gasoline and diesel consumption continued to increase, due to growth in disposable income and cheap fuel, as well as larger numbers of vehicles and larger vehicles being driven longer distances.

To date there are very few industrialized countries, with the possible exception of Singapore, where growth in transportation fuel consumption has been halted. The reasons are many but include the following:

- Cultural values in Canada favour single-family exurban homes on large lots and wide use of the private motor vehicle.
- Fuel prices are at historically low levels in North America. The relatively fixed percentage of disposable income used by consumers for transportation has allowed consumers to purchase new vehicles and to drive them longer distances. There is a well-established relationship between gasoline price and vehicle use. Fuel prices in European countries are typically two to three times higher than in North America, while per capita fuel consumption in the EC is in the range of one third of that in North America.
- It is argued that urban population densities are much higher and that public transportation systems are more highly developed in Europe than in North America. The counterargument is that it has been the availability of “cheaper” fuels and land in North America over many decades that has enabled wide use of the automobile and low density urban development. In order to meet sustainability objectives, we in North America may be forced to look seriously at patterns of urban development in other parts of the world, including Europe, for models of how we can have vibrant, liveable cities with less dependence on the automobile.
- The availability of inexpensive land, the economic policies of governments over past decades and advances in road transport technologies have encouraged massive investments in single-use urban development, road infrastructure and personal and commercial vehicle fleets that have overwhelmed public transit in urban areas and intercity transport of goods by rail.
- Historically, government policies at all levels, combined with market forces, have encouraged developments in road and air transport at the expense of modal share for rail, domestic shipping and public urban transport. Governments have subsidized low density urban and suburban development with land-use policies that preclude financially viable transit systems and foster automobile dependence. The fact that governments are now fiscally constrained may offer an opportunity to move to more compact, mixed-use urban form.

One of the major limitations of policy development for sustainable development has been that efforts to date have largely taken the form of doing those things “that are worth doing anyway” — for economic or other reasons in addition to environmental protection. As yet federal and provincial governments in Canada have not been able to agree on quantitative greenhouse gas emission reduction targets that would ensure real progress toward sustainable transportation.

With targets in place, it would be possible to evaluate the absolute and relative contributions of various measures or integrated packages of measures that could move Canada toward such targets. Recent analyses of measures for reducing the impacts of transportation in Canada provide the basis for linking targets and the effectiveness of measures.^{56, 57, 58, 59}

In Canada, jurisdiction over environmental issues, including air pollution, is shared among the federal government and the provinces (see Chapter 2). It is likely that the international community will attempt to establish more aggressive targets for environmental issues such as climate change. It is therefore important that, in advance of negotiating future international agreements related to issues such as targets for greenhouse gas emission reduction, the federal government work out a national negotiating position with the provinces. This anticipatory approach would ensure that the national position includes consideration of provincial interests in relation to provincial powers. The National Air Issues Coordinating Committee is one mechanism through which a coordinated national position on climate change might be developed.

One prominent commentator at the 1996 OECD conference, Towards Sustainable Transportation, suggested that policy makers should consider the following relative weighting of the effectiveness of the different classes of policy instruments:⁶⁰

- technology improvements in vehicles – relative weighting: 1
- shifting from single-occupant cars to “efficient” transport – relative weighting: 10
- shifting to non-motorized transport – relative weighting: 100
- elimination of “unnecessary” travel – relative weighting: 1000

As noted above, policy development in the transportation field has been dominated in the past by initiatives in category 1. Substantial investments have been made in urban transit infrastructure and services in Canada, but these investments have been overwhelmed by investments in road transport by all sectors of society. Limited research and even more limited policy and public investment have focused on categories 3 and 4, where the most substantial leverage seems possible. Mr. Britton’s numbers are admittedly rough — some would suggest outrageous — but they suggest where priorities may have to be placed to achieve truly sustainable transportation.

Other commentators at the Towards Sustainable Transportation conference addressed the need to shift the emphasis in policy approaches as follows:

- It is unlikely that governments will be able to achieve sustainable transportation through policy measures alone, even if coordinated approaches are taken by all levels pursuing integrated strategies. It will also take informed action by the majority of citizens (in their choices as consumers) and by businesses (seeing it to be in their best interests to offer goods and services that contribute to sustainable transportation). Hence governments have a responsibility to educate the public about how they can change their behaviours to enable real change to occur. Many observers have suggested that efforts to date have been very much at the margin and unlikely to result in real progress toward sustainable transportation.

- Measures promoting the use of compact urban form and mixed land use, as well as non-motorized forms of transport, have the potential to reduce the social isolation, barrier effects, public safety, health and environmental impacts of transportation and to increase the economic efficiency of society.

The report of the GTA Task Force to the Premier of Ontario in January 1996 (Golden report) estimated that capital investment in new road, sewer and water infrastructure could be reduced from \$55 billion to \$42.8 billion over the next 25 years by adopting a more compact mixed-use development pattern for the region.⁶¹ When capital, operating and maintenance, as well as external costs are taken into account, the Task Force estimated that the annual cost savings of containing urban sprawl would be about \$1 billion. This, it is argued, would reduce the cost burden on governments as well as increasing the economic competitiveness of the city-region in the global market.

The subsequent public debate on the recommendations of the Golden report generated little discussion of the collateral benefits that could be obtained through the reduced automobile use that could accompany the more compact mixed-use settlement pattern.

Similar conclusions to those of the Golden report have led the Greater Vancouver Regional District to adopt more compact urban settlement as an element of its long-range planning strategy.

The Towards Sustainable Transportation conference advanced the debate among transportation professionals. Preparation of sustainable development strategies by federal departments for submission to Parliament in December 1997 and the many activities at the provincial and municipal levels present excellent opportunities for further awareness building among planners, policy makers and the public.

Policy Instruments for Sustainable Transportation

Policy instruments are the levers governments use to encourage or mandate the changes required to create a sustainable transportation system.

Major Objectives of Policy Instruments

Regulatory/technology-based approaches have been used to date in North America to address emissions of air pollutants per unit of fuel consumption, improve fuel efficiency and impact many other aspects of sustainability. However, the evidence is overwhelming that regulatory/technology-based policy instruments have not and will not offset the impact of growth in vehicle-kilometres travelled or tonne-kilometres of goods moved. If sustainable transportation is to be achieved, there is broad consensus in the literature that major changes in consumer and business values and behaviours will be required.

Regulatory/Technology-Based Policies: Past and Current Focus

Regulatory/technology-based policies generally fall into the following categories:

- *Controls on air emissions:* Direct regulatory control of vehicle emissions has been the traditional approach to reducing air emissions from the transportation sector. Controls generally target tailpipe emissions. Such emission controls do not decrease carbon dioxide emissions. Moreover, gains in emissions per vehicle-kilometre or per tonne-kilometre from regulation tend to be offset by increased numbers of vehicles and by larger vehicles being driven longer distances.
- *Mandated improvements in fuel quality:* Use of reformulated fuels can reduce emissions of a range of pollutants. Reformulations can involve changes to a range of fuel characteristics such as levels of lead, benzene, aromatics and oxygenates in gasoline and sulphur and aromatics content, volatility and cetane number of diesel fuels. In some cases, reformulated fuels are essential to allow enhanced emissions control technologies to function effectively.

Like emission controls, fuel quality offers short- to medium-term opportunities to reduce vehicle emissions. In the long run, however, increased numbers of vehicles and vehicle-kilometres travelled will necessitate other actions if total emissions are to be reduced significantly.

- *Mandated increases in fuel efficiency:* Lowering the amount of fuel consumed per vehicle-kilometre can contribute to reduced fossil fuel use and reduced emissions. Changes to vehicle weight, aerodynamic drag, tire rolling resistance, transmissions, ignition and fuel management systems and other vehicle components can improve fuel efficiency.

Past experience with mandating fuel efficiency standards in the 1970s and 1980s, in North America, showed that although they led to improvements in average fleet fuel efficiency, total transportation fuel consumption continued to increase. This resulted from growth in numbers of vehicles, increases in distances travelled by each vehicle, and higher growth in sales of vans and light duty trucks compared with cars. Part of the increased vehicle use has been attributed by researchers to the lower operating costs that result from higher fuel efficiency.

The U.S. government and the U.S. automobile industry are cooperating in the Program for a New Generation Vehicle (PNGV) to develop a mid-sized car that is about three times more fuel efficient than current North American vehicles. Efforts of federal and provincial governments to establish Canadian participation in the PNGV have, so far, not been successful.

- *Promotion of alternative transportation fuels:* Even with stringent emission controls and fuel efficiency, petroleum-fuelled vehicles will continue to be major sources of air emissions. However, further emission reductions can result from use of lower carbon content alternative fuels such as alcohols, natural gas, propane, hydrogen,

and electricity from renewable resources such as biomass and solar energy. Choices in alternative fuels should be driven by life-cycle analysis of the total economic, social and environmental effects of producing, transporting and consuming each fuel.

The rate and extent of market penetration potential for alternative fuels is constrained by the state of technology, operational issues, low prices of conventional fuels and the massive societal investment already made in gasoline and diesel fuels. To date, alternative fuels represent approximately 1 percent of the transportation fuels market in Canada.

Policy Instruments for Reducing and Shifting Transportation Demand

Truly sustainable transportation is unlikely to be realized without major, long-term reductions in the use of high energy intensive modes of transport and shifts to lower energy consuming or non-motorized modes. Other policy instruments, in addition to those applied to date, will be required to reduce transportation energy consumption in the face of population growth, increasing per capita disposable income and advancing technologies that continue to reduce the costs of travelling greater distances.

Some of the types of policy measures that have the potential for major additional contributions to sustainable transportation include:

- *Measures which account for the constitutional division of powers in transportation:* The current division of powers among federal, provincial, and municipal governments makes land use and transportation planning and funding very fragmented in Canada. Actions in one jurisdiction can create conflicts with the policies or programs of other jurisdictions. For example:
 - ◆ Federal income tax policies allowing business tax deductions for employer-supplied parking but not for employer-subsidized transit passes work against provincial and municipal efforts to encourage higher transit use. It is understood that this issue is now under study in the federal Department of Finance.
 - ◆ Effective use of fuel taxation as an economic instrument for influencing long-term behavioural changes in the market would require coordination between federal and provincial levels since both have fuel taxation powers.
 - ◆ Municipal efforts to reduce transportation fuel consumption can either be reinforced or negated by federal or provincial tax policies.
 - ◆ The split of responsibility for road and rail transport between the provincial and federal governments makes it extremely difficult to develop integrated policy approaches for encouraging higher use of rail for both freight and passenger movement.

- ◆ Proposed changes to Actual Assessment of property taxes in Ontario could triple the already high municipal tax burden from \$20 million to \$60 million on all rail properties in the province, further threatening the financial viability of the rail mode in Eastern Canada.⁶²
- ◆ The federal government is responsible for participating in international deliberations on global and regional international issues and for negotiating Canada's commitments to international agreements. Conflict can occur if the federal government enters into such international negotiations without the support of the provinces in areas of provincial jurisdiction.

Governments need to find ways to ensure that interjurisdictional issues do not compromise progress toward sustainable transportation.

- *Use of economic instruments to influence market behaviour:* The use of economic instruments, including taxes and fees, to send strong, long-term signals to consumers for reduced automobile use and to manufacturers for sale of more fuel-efficient vehicles, has been the subject of much research and analysis internationally. However, there has been great resistance in North America to the use of fuel taxes for this purpose because of the entrenched cultural values and beliefs of North Americans.

In contrast, the use of such instruments appears to be gaining political support in various European countries, including the United Kingdom, despite the fact that fuel prices in Europe are already two to three times higher than in North America. If major advances in fuel efficiency can be achieved in future from initiatives such as the PNGV or the Hyper-Car proposed by Amory Lovins of the Rocky Mountain Institute, other policies such as economic instruments and/or emissions trading will be required to constrain increased personal vehicle use.

A wide variety of economic instruments has been suggested or implemented worldwide. Measures such as fuel taxation affect the broadest range of transportation users, and are said by their proponents to be among the most cost-effective measures. Alternatives such as vehicle registration fees and/or insurance premiums tied to annual vehicle or fuel use have been proposed. More narrowly focused instruments such as road congestion pricing or gas guzzler taxes have also been suggested.

- *Changes in land use, urban design and transportation planning:* Provincial municipal planning legislation, as well as regulation of zoning and building codes, can influence urban settlement patterns by encouraging more compact, mixed land use to reduce transportation demand, increased use of non-motorized modes such as walking and cycling, and shifts to public transportation systems. Some of the specific aspects requiring attention include:
 - ◆ integration of transportation and land-use planning;
 - ◆ modification of transportation decision making to ensure selection of least societal cost modal alternatives and interjurisdictional integration of public transportation systems;

- ◆ long-term commitment to providing transportation alternatives to ensure improved access for all citizens, as policies constraining high energy intensive modes take effect.

Some progress is starting to be made in sustainable transportation planning and implementation at the municipal level in Canada. Change is happening on at least two levels. At the regional level, the planning of transportation networks is concerned with changing origin/destination patterns to minimize passenger-kilometres travelled using high fuel-consuming modes. An example of the above is integration of transit services within a region to ensure optimized services across municipal boundaries and among modes.

At the neighbourhood or street level, the contributions to sustainability tend to be architectural or design solutions that ensure close connection of activities, priority for walking and other non-motorized modes, and urban design that supports quality public transit.

Catalysts for change toward sustainability at the local level include the initiatives of the International Council for Local Environmental Initiatives, the Transportation Association of Canada, the Federation of Canadian Municipalities, the Canadian Urban Transit Association, the Canadian Urban Institute, the Institute for Sustainable Cities, the Centre for Sustainable Transportation, Pollution Probe and the York University Centre for Applied Sustainability.

- *Increased public education and awareness:* Achieving change on the scale required for sustainable transportation will only be possible if the public is well aware of the risks of the status quo and is ready to change its values, behaviours and beliefs. The literature suggests that the job cannot be done solely by interventions of governments.

The public will have to be convinced that it is in society's long-term interest to take action to modify the way we live. The message will be much more palatable if it can be shown that there can be long-term economic and social and lifestyle benefits from the changes needed to reduce transportation energy use. There are many examples from past battles for environmental change. Some of the strongest advocates for clean up of industrial processes are leaders of companies and industry associations who initially resisted regulation but have realized improved profitability from their subsequent efforts to reduce waste.

A Menu of Policy Instruments

The literature on sustainable transportation describes hundreds of individual policy measures that have been suggested, analysed and/or implemented as contributions toward sustainable transportation. There are frequent calls for the application of policy instruments using specific approaches that are "integrated," "coordinated," and "phased." These elements are described in more detail below.

An Integrated Approach: Packaging the Policy Instruments

Achieving sustainable transportation will require integrated packages of policy instruments. The problem is too complex and multifaceted to be addressed by one or even a small number of policy instruments. It will be necessary to combine different policy instruments, each with its own strengths, weaknesses and objectives, into politically acceptable, integrated packages coordinated among all levels of government.

Some integrated packages of policy instruments already exist or have been proposed. Examples are the Greater Vancouver Regional District's Air Quality Management Plan and the NOx/VOC Management Plan, and the Strategy for Sustainable Transportation in Ontario proposed by the Transportation and Climate Change Collaborative. On the other hand, Canada's NAPCC does not provide an integrated package for transportation. It does not present a comprehensive package of policy instruments to exploit the full range of emission reduction opportunities.

Effective integrated packages are likely to contain policy instruments that rely on different approaches, including "command and control" regulations, economic instruments, provision of education and information, transportation and land-use planning, and technology development. Understanding how these approaches interact is essential to developing an effective package.

Regulatory Instruments

Regulatory instruments are policy instruments that (1) command people and companies to change their behaviour in specified ways; and (2) specify the penalties that will be imposed if they do not obey. Examples include vehicle emission standards, fuel standards, mandatory fuel conversion of vehicle fleets and speed limits.

Regulatory instruments work best when there is only a small number of players, such as petroleum refiners or auto makers, to be regulated. When the behaviour of millions of people and companies needs to change, "command and control" approaches become less enforceable.

Mandating technological change is one possible role for regulatory instruments. Vehicle emission standards, fuel standards and fuel efficiency standards are prominent examples of regulated technological change.

More stringent standards for vehicle emissions and fuel efficiency are important for reducing air emissions in the medium term. However, even if the recommendations of the Canadian Council of Ministers of the Environment's Task Force on Cleaner Vehicles and Fuels are implemented, vehicle emissions will eventually rise due to the increases in the number of vehicles on the road and vehicle-kilometres travelled.

Other examples of technological regulations include mandating the conversion of all or a portion of a vehicle fleet to use an alternative fuel or electricity.

Economic Instruments

Economic instruments, or "market-based incentives," are policy instruments that create price signals to encourage behavioural change.

In at least two ways, encouraging sustainable transportation is an ideal application of economic instruments. First, each individual has a contribution to make to achieving sustainable transportation. On a daily basis, the sustainability of the transportation system is affected by millions of decisions, such as walking to the store rather than driving, buying local rather than imported produce, spending a vacation locally rather than abroad, or driving a car instead of a sport utility vehicle. Behavioural change on such a “micro level” is not well suited to command-and-control approaches, but is the *raison d'être* of economic instruments.

Second, the current lack of urgency surrounding the sustainable transportation issue suggests that voluntary approaches are unlikely to lead to changes on the scale required. When economic instruments are visible to consumers, they act as reminders of the consequences of purchasing decisions. In this way, some economic instruments increase consumer awareness much as public education programs do. Education programs can also improve the effectiveness of economic instruments by raising public awareness of the intent of economic instruments.

Economic instruments have the potential to have a dual effect on sustainability. They can directly reduce demand for transportation energy consumption from high fossil energy consuming modes. Revenue from such instruments can be invested in other measures that encourage reduced fossil energy consumption.

The use of economic instruments on a scale that would have a major impact on progress towards sustainability could result in large changes in tax structure, since large tax revenues could be generated. The design of individual economic instruments or packages of instruments for Canada would have to include consideration of issues such as revenue neutrality, economic impacts and social equity. This implies that we could experience a significant shift away from income-based taxation to heavier taxation of consumption. The literature suggests that such changes are feasible and may in fact be cost effective and equitable. Canada faces the particular challenge of ensuring that the use of economic instruments does not compromise its economic competitiveness with the United States.

Public Education

Public education programs are planned, targeted approaches to promote voluntary social change through persuasion. Littering, recycling, seat-belt use, drunk driving and many other issues have all been the target of education campaigns to promote social change.

“Social marketing” can influence behaviour by increasing awareness of a problem, the actions that can be taken to reduce the problem, and the costs and benefits of these actions. Frequently, they also rely on moral suasion to encourage change.

Achieving sustainable transportation will require sustained public education for several reasons:

- The unsustainability of current transportation trends is not well understood. Public education can build a better and more widespread understanding of the environmental impacts and costs associated with transportation infrastructure decisions and personal behaviour.

- Current patterns of transportation, particularly our heavy reliance on the automobile, are deeply ingrained. Behavioural change will not come without significant changes in our way of thinking.
- Public support for some of the tougher policy instruments that will be needed is weak. Public education regarding the benefits of tough measures can provide support for political action.

Education encompasses a wide range of policy instruments suitable for encouraging different types of behavioural change. Policy instruments include vehicle fuel efficiency labelling, environmental codes of practice, incorporating information about sustainable transportation into school curricula, media campaigns, driver training and highway signs.

Transportation and Land-Use Planning

Altering transportation demand will require significant changes in our lifestyles and business operations. These changes can only occur within a new transportation and land-use infrastructure. Planning practices related to transportation and land use will, therefore, be important to achieving long-term transportation sustainability. Decisions related to public infrastructure investments, urban development approvals, traffic control and other planning issues will be affected.

Technology Development

There are two schools of thought regarding government's role in technology development. One position is that governments should focus strictly on using regulatory instruments to mandate the private sector to develop new technologies that meet increasingly stringent standards. Another position sees government playing a more active role in encouraging new technologies. If government is to play an active role, it can act in several ways:

- Offer tax incentives, grants and other financial incentives for private sector research.
- Participate in joint research and demonstration programs, such as the Ballard Fuel Cell program in Canada, aimed at developing a vehicle propulsion system using a hydrogen fuel cell to produce electricity, or the U.S. Program for a New Generation of Vehicles, aimed at developing a mid-sized car with a fuel economy rating of 80 miles per gallon.
- Conduct in-house research through government agencies and institutes.

Governments are already using all three policy approaches. The question is whether their use should be expanded. In fact, if the threats to the human species implied by the warnings of the Intergovernmental Panel on Climate Change are taken seriously, Canada may be well advised to reconsider its research and development priorities in favour of a major shift in focus to R&D that can contribute to absolute reductions in fossil fuel use in transportation.

Integrated Policy: The European Approach

The OECD study *Urban Travel and Sustainable Development* offers an example of an integrated approach to policy instruments (Exhibit 3.3).⁶³ This study concluded that integrated strategies were not only necessary but that “their benefits — economic, environmental and social — will greatly outweigh their costs.” The proposed integrated approach has been approved by the European Conference of Ministers of Transport.

Exhibit 3.3

Integrated Approaches to Sustainable Transportation: An OECD Example for Urban Travel

The OECD integrated policy approach contains three main strands:

- ◆ **Best Practice:** raise the effectiveness of current land-use planning and traffic management measures ... to the level of those in the best managed cities.
- ◆ **Policy Innovations:** develop new policies aimed at bringing demand for car travel into balance with road capacity.
- ◆ **Sustainable Development:** introduce repeated annual increases in motor fuel taxation to promote more economical vehicles, shorter and fewer car trips, a shift in travel away from solo driving and greater use of environmentally friendly modes.

“All three strands of the policy package are necessary to reduce car travel ... to improve accessibility for those without cars and to achieve sustainable urban development. Together they could reduce substantially the economic, environmental and social costs of travel in OECD countries, currently estimated to be equivalent to about 5 percent of Gross Domestic Product.”

All three strands should be pursued starting immediately. Applying Best Practices would have its major impact in the period to the year 2000. The Policy Innovations strand is projected to be in place and effective by the year 2015. The effect of the first two strands would be to slow but not stop the growth in transport energy consumption and other impacts of transportation.

“Only the Sustainable Development strand, combined with the other policies, lowers urban car travel generally and reduces overall car travel, allowing CO₂ emissions to meet the IPCC [Intergovernmental Panel on Climate Change] target value [of a 60 to 80 percent reduction in CO₂ emission levels] by about 2030.”

Source: Organization for Economic Cooperation and Development, *Urban Travel and Sustainable Development* (Paris, 1995), Chapter 8.

A Coordinated Approach: A Role for Everyone

All levels of government and other stakeholders will likely be involved in developing and implementing packages of policy instruments. A coordinated approach to the assessment, selection, design and implementation of the packages is essential for several reasons.

First, coordination is required to create effective packages consistent with jurisdictional responsibilities. Each level of government has different policy instruments available to it and is constrained in different ways in how it applies the instruments.

Second, coordination can avoid duplication of policy instruments. Avoiding duplication will be particularly important if a full costing approach is adopted. Under full costing, the total costs paid by transportation users through vehicle registration fees, user fees, fuel taxes and other payments should equal the full public, private and external costs.

Third, coordinated packages will allow exploitation of synergies among policy instruments. For example, an increase in fuel prices may cause some people to use public transit instead of private vehicles. However, coupling a fuel tax increase with investments in more attractive public transit may have a much greater effect.

Finally, coordinated packages will counter some of the undesirable effects of individual policy instruments. As examples, consider the following:

- Policy instruments that mandate increases in fuel efficiency will decrease fuel consumption per vehicle-kilometre travelled. However, lower fuel costs could mean people travel more, thereby offsetting some of the benefits of fuel efficiency. More stringent fuel efficiency standards could be combined with higher fuel taxes to maintain a constant or increasing fuel cost per vehicle-kilometre.
- Policy instruments that decrease congestion will lower travel time and cost, thereby encouraging more travel. Higher parking prices and/or road pricing might offset any tendency for more travel on less congested roads.

A Phased Approach: Do What We Can Now and Prepare for a Sustainable Future

Given the magnitude and complexity of the change involved, a sustainable transportation system will evolve only over several decades or more. Changes to urban forms and lifestyles will occur slowly. Some technologies now on the horizon will gradually emerge as new practicable technological standards. Nonetheless, there are immediate reforms that can improve or avoid further deterioration of the current situation. Furthermore, long-run changes will only occur if pushed by policy instruments implemented in the short run.

Logical starting points for short-run actions include:

- Providing education on the unsustainability of current transportation practices, the consequences of not taking action, the actions to take to encourage sustainability, and the costs and benefits of those actions — placing the emphasis on reducing fossil fuel consumption by encouraging changes in public values and behaviours.

- Implementing reforms in regions most affected by unsustainable transportation (air quality non-attainment zones).
- Incorporating targets for sustainability into today's infrastructure investment, land-use and transportation planning decisions that will determine transportation patterns for many years to come. Governments must ensure that accessible alternatives are available as public values change and transportation demand shifts away from energy intensive modes.
- Implementation of more stringent standards to fully exploit the emissions control and fuel efficiency opportunities available now.
- Raising fuel prices to encourage fuel efficiency improvements and alternative fuel technologies, mode shifting and reduced vehicle use, a policy instrument shown to be effective in the 1970s.
- Focusing, as a national priority, on research and development that builds on Canada's particular strengths and is aimed at reducing fossil fuel consumption from transportation.

Footnotes

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Appendices



Appendix A

Interviewees

The original draft of this report was distributed to the following individuals for their comments. Where possible, meetings or telephone interviews were held to obtain feedback.

List of Organizations and Persons Interviewed

Organization	Contacts
Environment Canada	Anne Mackenzie, Julie Charbonneau, Russ Robinson
Department of Finance Canada	Ann Park, Larry Weatherly
Fisheries and Oceans	Mike Turner
Health Canada	Dan Krewski, John Harrison
Natural Resources Canada	John Lowe, Marie Schingh, Baxter MacDonald, Alan Delenko, Nick Beck
Transport Canada	David Bell, Vic Thom, Wayne Kauk
Canada Mortgage and Housing Corporation	Lorne Finlay, David D'Amours
Canadian Council of Ministers of the Environment	Liseanne Forand
National Air Issues Coordinating Committee	Tony Rockingham
Ontario Ministry of Environment and Energy	Tony Rockingham, Doug McCallum
Office of the Greater Toronto Area, Ontario Ministry of Municipal Affairs	Rob Milligan
British Columbia Ministry of Environment, Land and Parks	Denis Bergoza
Transportation Association of Canada	John Hartman
Federation of Canadian Municipalities	Dan MacGregor, Kathy Thompson
University of British Columbia, Department of Health Care and Epidemiology	David Bates
University of Quebec at Montreal	Jacques Ruellan
Centre for Sustainable Transportation	Richard Gilbert
International Center for Sustainable Cities	Martin Crilly
IBI Group	Neal Irwin

Appendix B

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Appendix C

Decision-Making Principles

This appendix contains principles of sustainable transportation suggested by the following agencies:

- ◆ National Round Table on the Environment and the Economy
- ◆ Transportation Association of Canada
- ◆ Transport Canada
- ◆ International Council for Local Environmental Initiatives
- ◆ Canada's National Action Program on Climate Change
- ◆ Canadian Urban Institute

National Round Table on the Environment and the Economy

At the request of the federal Minister of the Environment, the National Round Table on the Environment and the Economy (NRTEE) initiated a consultative process to develop a draft set of sustainable transportation principles. They were presented at the March 1996 OECD conference, Towards Sustainable Transportation, held in Vancouver. These draft principles, as amended at that meeting, are presented on the following page.

Sustainable Transportation Principles

Principles	Description
Access	
Access	People are entitled to reasonable access to other people, places, goods and services, as well as responsible information that empowers them towards sustainable transportation.
People and Communities	
Equity	Nation states and the transportation community must strive to ensure social, inter-regional and inter-generational equity, meeting the basic transportation-related needs of all people including women, the poor, the rural, and the disabled. Developed economies must work in partnership with developing economies in fostering practices of sustainable transportation.
Individual and Community Responsibility	All individuals and communities have a responsibility to act as stewards of the natural environment, undertaking to make sustainable choices with regard to personal movement and consumption.
Health and Safety	Transportation systems should be designed and operated in a way that protects the health (physical, mental and social well-being) and safety of all people, and enhances the quality of life in communities.
Education and Public Participation	People and communities need to be fully engaged in the decision-making process about sustainable transportation, and empowered to participate. In order to do this, it is important that they be given adequate and appropriate resources and support, including information about the issues involved, as well as the benefits and costs of the array of potential alternatives.
Integrated Planning	Transportation decision makers have a responsibility to pursue more integrated approaches to planning.
Land and Resource Use	Communities should be designed to encourage sustainable transportation and enhance access, as a contribution to providing comfortable and congenial environments for living. Transportation systems must make efficient use of land and other natural resources while ensuring the preservation of vital habitats and other requirements for maintaining biodiversity.
Environmental Quality	
Pollution Prevention	Transportation needs must be met without generating emissions that threaten public health, global climate, biological diversity or the integrity of essential economical processes.
Economic Viability	
Economic Well-being	Taxation and economic policies should work for, and not against, sustainable transportation, which should be seen as contributing to improvements in economic and community well-being. Market mechanisms should support fuller cost accounting, reflecting the true social, economic and environmental costs, both present and future, in order to ensure users pay an equitable share of costs.

Transportation Association of Canada Decision-Making Principles

- Plan for increased densities and more mixed land use.
- Promote walking as the preferred mode of person trips.
- Increase opportunities for cycling as an optional mode of travel.
- Provide higher quality transit service to increase its attractiveness relative to the private automobile.
- Create an environment in which automobiles can play a more balanced role.
- Plan parking supply and price to be in balance with walking, cycling and transit priorities.
- Improve the efficiency of the urban goods distribution systems.
- Promote inter-modal and interline connections.
- Promote new technologies that improve urban mobility and help protect the environment.
- Optimize the use of existing transportation systems to move people and goods.
- Design and operate transportation systems that can be used by the physically challenged.
- Ensure that urban transportation decisions protect and enhance the environment.
- Create better ways to pay for future transportation systems.

Source: Transportation Association of Canada, *A New Vision for Urban Transportation*, March 1993.

Transport Canada

A discussion paper from Transport Canada staff suggests principles for integrating environmental considerations into decision making as a starting point for building sustainable development.

Decision-Making Principles

- Respect for ecological integrity.
- Efficient use of natural, manufactured and social capital.
- Promoting equity in terms of access to service, now and in the future.
- Committing to participatory approaches.
- Environmental stewardship by all decision makers.

Source: D. Bell, R. Delaney and R. Lewis, *A Proposal for Sustainable Transportation — A National Framework* (Ottawa: Transport Canada, 1966).

International Council for Local Environmental Initiatives

The International Council for Local Environmental Initiatives (ICLEI), in its guide to municipalities entitled *Saving the Climate — Saving the Cities*, suggests six principles to guide local authorities toward sustainability. These principles, with modification, could be adapted by any level of government in the development of sustainable transportation policies within its jurisdiction.

Decision-Making Principles for Local Authorities

- *Ecological integrity* — Sustainable (transportation) requires that economic activity be environmentally sustainable. The current dependency on cars, intercity goods movement by truck and the growing impacts of aviation are environmentally unsustainable. This has, of course, profound implications for the long term structure of key sectors of Canadian and global industry.
- *Emphasis on prevention* — The principle “anticipate and prevent” needs to replace “react and cure” in guiding government authorities to better manage urban growth, transportation, energy systems and waste.
- *Reduction of poverty* — Sustainable transportation requires that all people’s needs be met. Wealth that governments at any level help to create that is not distributed to meet these needs means that the development is fundamentally flawed.
- *Equity among generations and social groups* — People’s needs should be met in a manner that does not diminish the ability of future generations to meet their needs. Authorities can implement this principle by managing economic growth in a way that minimizes, on a per capita basis, the life cycle energy that citizens consume for transportation.
- *Precautionary approach* — Lack of scientific certainty should not be a reason for delaying an action to prevent social, environmental and economic damage. Given the great risks involved, enough consensus exists today on the serious negative social, health, climate change and economic impacts of current trends in transportation to compel action from governments at all levels.
- *Polluters should pay* — Those who pollute and degrade the environment through their transportation decisions should bear the full social and environmental cost of their pollution. Authorities can turn to economic measures, such as taxes and fees, to implement this principle.

Source: International Council for Local Environmental Initiatives, *Saving the Climate — Saving the Cities*, 1995.

National Climate Change Action Program

Canada's National Action Program on Climate Change (1995) sets out principles to be used by the Canadian government in meeting its commitments under the United Nations Framework Convention on Climate Change. Readers should note that the NAPCC's list of principles includes only one in common with the ICLEI's principles, namely, the precautionary principle. In addition, the principles do not mention modifying behaviours.

Decision-Making Principles

- *Precautionary principle* — lack of scientific certainty should not be used as a reason to postpone mitigative actions which are cost effective or justified for other reasons.
- *Shared responsibility* — with all sectors of society.
- *Effectiveness* — measures that clearly reduce greenhouse gas emissions.
- *Competitiveness* — measures which do not compromise Canada's international competitiveness.
- *Transparency and accountability* — establish who is to be accountable.
- *Flexibility* — to change with experience and technology.
- *International co-operation* — as part of a global effort.
- *Strategic directions* — working to reduce Canada's net greenhouse gas emissions for 2000 and beyond.

Canadian Urban Institute

The Canadian Urban Institute's *Cities Without Cars* study outlines two sets of decision-making principles, one from each of its study teams (Toronto and Vancouver). There is significant overlap between the principles proposed by the two teams, as well as interesting differences. For example, the first three principles for Toronto — comfort, convenience and efficiency of travel — correspond to Vancouver's principles #3 and #11. However, the Toronto principles have a stronger focus on travel characteristics and the Vancouver principles have a stronger focus on equity and fairness.

Decision-Making Principles

Toronto

- 1 Travel in the GTA without cars should be at least as *comfortable* as travel in the GTA today.
- 2 Travel in the GTA without cars should be at least as *convenient* as travel in the GTA today.
- 3 The GTA without cars should [be] at least as *efficient* as the GTA today.
- 4 Travel in the GTA without cars should have *less impact on the environment* than travel with cars.
- 5 Travel in the GTA without cars should be at least as *safe and secure* as travel in the region today.
- 6 The process of reconfiguring the GTA must be gradual and fair and be such as to *enhance the social fabric* of the GTA rather than diminish it.
- 7 Residents of the GTA without cars will have at least as much *access to green space* within the region and outside, as residents of the region today.

Vancouver

Lifestyle Principles

- 1 Minimize impacts upon auto users and auto dependent services when changing from auto dependency to an auto-free lifestyle.
- 2 Promote understanding and knowledge of the benefits of an auto-free city to ensure that any perceived or real changes to lifestyles are supported by those affected.
- 3 Ensure that comfort, convenience, and efficiency of travel is similar to, or exceeds, existing levels of user experience.

Economic Principles

- 4 Fully account the true costs of auto use against the costs associated with building an auto-free city.
- 5 Ensure that the full costs for building/operating an auto-free city are substantially less than the costs of an auto city.

Environmental Principles

- 6 Re-orient auto-dependent resource industries in an orderly and equitable fashion.
- 7 Minimize detrimental impact upon auto-dependent activities.
- 8 Ensure that the auto-free city displays improved air quality and other environmental benefits.
- 9 Ensure that any development associated with an auto-free option must be environmentally sustainable.

Social Principles

- 10** Promote an equitable system of moving goods and people in the auto-free city.
- 11** Ensure that comfort, convenience, and efficiency are similar to, or exceed, existing levels of user experience.
- 12** Recognize increased personal and public safety as a major real and perceived benefit of an auto-free city.

Political Principles

- 13** Need for political will and massive public support to move to an auto-free city.
- 14** Need to address all of the issues relating to converting to a city without cars at a regional level.
- 15** Need structural changes and associated municipal changes to respond to all requirements.

Source: Canadian Urban Institute, *Cities Without Cars* (Toronto, 1994).



**Sustainable
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on the Environment
and the Economy



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